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THE
MEDICAL TREATMENT
OF DISEASE

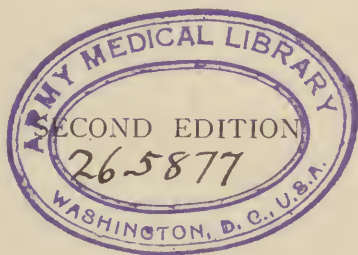
NOTES ON THE MEDICAL TREATMENT OF DISEASE

FOR STUDENTS AND YOUNG PRACTITIONERS
OF MEDICINE

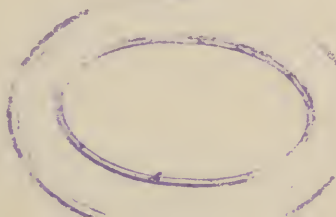
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BY

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TORONTO:
McCLELLAND AND STEWART
1923



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PRINTED IN CANADA

TO
ALEXANDER McPHEDRAN,

LL.D., M.D., Emeritus Professor of Medicine in the University of Toronto.

This little book is affectionately dedicated in memory of our long years of close association in the University of Toronto and in the Toronto General Hospital, and as a slight token of appreciation of the high standard of thorough work which he established in these two institutions.

PREFACE TO THE FIRST EDITION.

The aim of this little work is to impress upon the student and young practitioner the broad principles of the medical treatment of the sick, and to urge the importance of method in dealing with patients. In the teaching of clinical medicine, the need of system in physical examination is fully recognized—thus the student is early taught to work in the order of inspection, palpation, percussion and auscultation—but this system is sometimes lacking when one comes to treatment.

No attempt is made here to discuss all treatment of all diseases. This would be manifestly impossible in the space, and, moreover, would defeat the end in view. In a volume of this kind, details and special treatments must be largely omitted or only hinted at. The student will get much minute instruction during his courses in the special branches of medicine, but it is hoped that what is here given may serve as a foundation upon which he may build that which he will gain from teachers and writers specially qualified to impart such information.

All along, the effort will be made to impress upon the reader that we are not in practice dealing with disease, but rather with diseased individuals, which is quite a different thing. The question should not be, "what is the treatment of (let us say) pneumonia?" but rather, "how can we best care for the patient so that he may weather the pneumonic storm?"

The ever-growing importance of the science of pharmacology is evident, and drug therapy is based upon it almost as much as is medicine upon physiology and pathology. At the same time, it must be conceded that we are still ignorant of how many of our best remedies act and, while always hoping and striving after a reasonable explanation of their *modus operandi*, we can only in the meantime use them because they have been found to do good. If a treatment called "X" tends to relieve a condition called "Y," it is the duty of the physician to employ it even if he cannot yet give the values of "X" and "Y." Much of our best therapy is still empirical and must necessarily remain so for long.

The difficulties of writing upon treatment are very great. As Withering said in 1785: "It is much easier to write upon a disease than upon a remedy. The former is in the hands of Nature, and a faithful observer with an eye of tolerable judgment cannot fail to delineate the likeness; the latter will ever be subject to the whims, the inaccuracies and the blunders of mankind."

No one knows the shortcomings of this book as well as does the writer, yet it is with the hope that it may be of some use to the student and the young practitioner that it is now launched upon the medical public.

R. D. RUDOLF.

Toronto,
1st January, 1921.

PREFACE TO THE SECOND EDITION.

In the two years since this book first appeared the edition has become exhausted and I have been asked by the publishers to get ready a second one in time for the coming Session of the Universities.

Since the first edition went to press I have constantly endeavoured, being only too conscious of its many shortcomings, to improve the book, and to keep it up to date, and therein lay my chief difficulty. The subject of treatment is so large and so constantly changing that it has proved hard to keep within the former limits without omitting much of real importance. This has been partially accomplished by the deleting of a good deal of what formerly appeared. I have to acknowledge with pleasure much friendly criticism and advice from my colleagues in the Medical Faculty of the University of Toronto, and especially to thank Dr. Almon A. Fletcher for revising and improving the section on Insulin. Every line of the book has been personally gone over and a great deal of it re-written, and the valuable suggestions of the different reviewers have been fully taken advantage of. Nevertheless, in spite of many changes, the fundamental plan of the work has been maintained as it seemed to be of use and to meet with approval.

The reader will not find here a complete reference textbook, but it is earnestly hoped that this second edition of the work may be of some practical use to him in many of the difficulties that arise in the daily medical care of the sick.

R. D. RUDOLF.

Toronto,

October, 1923.

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CHAPTER I.

INTRODUCTORY REMARKS.

The term Therapeutics is derived from the Greek verb *Therapeuein* which means to take care of, or to heal, and represents naturally the most important subject that can occupy the attention of the practitioner of medicine.

"They that are whole have no need of the physician, but they that are sick," and when a man feels that the wheels of life are not running smoothly, that aches and pains disturb him, or in any way realizes that he is not himself, he turns to his physician in the hope that that trusted friend may help him to return to his former state of health.

The student of medicine, as he works his way through the mazes of physiology, anatomy, pathology and physical diagnosis, sometimes fails to keep clearly before his mind that these and all kindred sciences, although they be the very foundations of his future work, are after all but hand-maidens of the chief object that he should keep ever in view, which is the healing of the sick and the relief of human suffering.

Medicine is an art as well as a science, and it is undoubtedly true, as the late Dr. Forchheimer said, that there are "doctors of medicine who are not physicians at all, though they practise medicine! They are pathologists, bacteriologists, what you will, in the disguise of physicians." When a doctor is called to the bedside of a sick man, he is there to cure or to relieve, and while the more he exhausts every known method of arriving at a diagnosis the better he will be able to help the patient, yet he must never forget that he is there as a therapist, and it is only on that account that the eyes of the sufferer follow him, and every word that he drops is so eagerly listened to.

While drugs form a very important part of the therapist's armament, they are far from being his only weapons, and he must concern himself with every physical, psychical and other factor which may help the sick man in his struggle back to health. It is, in fact, not an uncommon thing for the practitioner to best help the patient by stopping all drugs, with

which the sufferer may have been thwarting Nature in her endeavours to restore him, and thus he may practice the best therapy by vetoing all medicinal treatment.

The therapist may be likened to a guide trying to lead his party, the patient, back to the goal called Health. Sometimes the road is broad and clear, having been already surveyed and mapped out by the physiologist, pathologist and other scientists, and the guide goes confidently ahead. But it may be that the country is difficult, and one in which there are no cleared roads or even blazed trails. What is he to do? Give up his guideship and abandon his party to its fate? No! By all means, no! But if he does so, perchance some native may glide out of the bush, and taking the patient by the hand may lead him by pathways that are on no map, but which the native has learned by experience lead to safety, and so may save him. Such paths are empirical and have not been yet shown by scientists to lead correctly and yet they often do so. Many of our best remedies have been discovered empirically and after ages of use have been found to be good paths. They have since been surveyed and mapped out and often improved and have been scientifically endorsed, but we must remember that they were used by ignorant natives long before they got into the pharmacopoeias. Even yet, the explanation of how many of our best drugs act has not got beyond the stage of hypothesis, let alone theory. It ill becomes anyone to condemn any treatment merely because he cannot explain how it brings about good results. If it be established by clear clinical evidence that the drug or remedy does good, let us try our best to find out its way of action, but in the meantime use it for the relief of our patients.

The history of the evolution of treatment forms a most interesting and often rather humiliating chapter of Medicine.

We know that the lower animals have many simple remedies which instinct has taught them are for their bettering. One cannot watch a dog, which has eaten something that disagrees with him, select a certain grass as an emetic without realizing that he has a therapy. In the same way the most primitive peoples found out many things which have proved to be of the greatest value in certain diseased conditions.

Thus was cinchona discovered, also opium and perhaps the majority of our best remedies. Psycho-therapy, or the curative power of the mind over disturbed conditions of the body or mind, was early developed, as shown by the driving out of devils, and many other persuasive or suggestive methods of treatment.

As reason developed, primitive man began to theorize about disease and its treatment. Examples of different theories that have held sway for long, and have influenced the treatment of disease in the different ages, are almost numberless, but a few may be mentioned.

The idea that all disease is of supernatural origin is a very early one and it held sway for many centuries, and still holds good in many parts of the world. With such a theory in the ascendancy naturally all treatment was directed towards the driving out or the tempting out of the spirit that possessed the sufferer. By many it was believed that the spirits actually entered the body and, indeed, were the disease; by others that they in some way caused the ailment without actually entering, while "The Babylonian considered the great God Marduk the expeller of all maladies, whereas Urugal, Namtor, and Nergal were recognized gods of pestilence."

Where the firm belief exists that a god or goddess (usually the latter) is the cause of disease, it will not be long before we have evidence that such a spirit has actually been seen; and not long ago, when the plague was raging in Bombay (due, as both the Hindoos and the Mahometans believed, to the plague goddess) a witness soon appeared in the form of an old woman, whose eyes had been cleared by a visit to the sacred city of Mecca. This woman swore that she had seen the plague spirit, in the form of a gaunt female with bloody fangs and fleshless sinewy arms, sheeted in white, stalking through the streets of the stricken city. Similarly, during an outbreak of small-pox in Calcutta in 1897, it was believed that the goddess Sitala (the deity presiding over small-pox) was seen at the dead of night, this time by a native policeman, passing along one of the public streets. In consequence, the people flocked to the shrine of this goddess and offered up prayers and gifts. The epidemic just then began to decline

(doubtless owing to the excellent work of the health officer of the city), and the people, of course, believed that the goddess was appeased.

The transference of disease was formerly very widely believed in, and in the East one still comes across the idea. It is the old idea of the scapegoat. When cholera is raging in an Indian village a dreadful noise is kept up by the villagers, in the hope that they may scare away the goddess of the disease. In the surrounding hamlets the people are keenly alive to their danger, and they also make all the noise possible, by the beating of tom-toms and the blowing of horns, to prevent the goddess from coming their way. The competition is apt to become acute and may lead to bloody feuds between the villages.

Another variety in the supernatural theory of disease is that there exists a sympathy between the person afflicted and the animal or person who passes on the ailment. On this account one sees the Indian natives preserve with the greatest care the life of a venomous snake which has bitten one of their number. They believe that there now exists such a sympathy between the snake and the person whom it has bitten that if it be destroyed then its victim will also die. Somewhat the same idea is seen in the folk lore of many countries, where images are tortured or destroyed with the idea that what happens to the images will also happen to the originals.

The belief in the supernatural origin of disease gave rise to all manner of strange methods of treatment, many of which still survive in civilized communities, although their origin is forgotten. Thus many people wear iron rings to keep off rheumatism, and iron comes down from the earliest times as perhaps the best spirit-scarer known.

Exorcism, or the driving out of spirits, is the way in which most remedies were supposed to act, and an endless variety of means were employed to this end. Naturally, the priests were most concerned in thus dealing with the supernatural, and hence they did most of the medical practice in olden times. All sorts of things were used as spirit scarers, some of which still survive and are amongst our best remedies, although now we have a different theory of how they act. Iron and cinchona

•

bark are two such remedies, and both were originally used for the scaring out of spirits. Relics, such as the clothing of departed saints, were greatly in favor and tombstones were very powerful in the same way. Even the washings of tombstones had special virtues. See what Gregory of Tours said of such:—"Oh! indescribable mixture, incomparable elixir, antidote beyond praise; celestial purgative, which throws into the shade every medical prescription, which surpasses in aroma every earthly fragrance, and is more powerful than all essences . . ., which not only cures the ailing limbs, but, also, and this is more valuable, washes off the stains from the conscience." (Magnus). Such a remedy evidently cured, and nowadays we would say that it acted by suggestion, the patient taking some of the tomb washings in perfect faith that it would cure,—for example, his aching head, and, presto! the pain would disappear. The nastier the taste of the medicine the more likely it would be to drive out the offending spirit, and this is probably the origin of the belief among many people that disagreeable medicines are the most powerful. "It must be a good medicine, it is so nasty," is a remark often heard.

Many remedies that attained great celebrity no doubt acted as antiseptics. In this way may perhaps be explained the value, for example, of "dog oil", which for ages was famous. Ambrose Paré in 1540 wrote as follows: "When I was at Turin I found a surgeon famed above all the rest for his treatment of gun-shot wounds; into whose favour I found a way to insinuate myself that I might have the recipe of his balm, as he called it, wherewith he dressed these wounds. He made me pay my court for two years before I could possibly get the recipe out of him. In the end, thanks to my gifts and presents, he gave it to me, which was this—Boil down, in oil of lilies, young whelps just born, and earth worms prepared with Venice turpentine. Then I was joyful and my heart made glad that I had learned his remedy".¹ Call evil spirits microbes and spirit scarers antiseptics and much ancient therapy is brought up to date.

¹*Lancet*, Dec. 20th, 1921, p. 1255.

A good example of psychotherapy was the effect of temple sleep, which for ages held such powerful sway in Europe. This method of treatment was most extensively used during the period of Hellenic civilization, in the centuries preceding the Hippocratic era. Sufferers from all manner of ailments would resort to the temples and there sleep for a night or more, sometimes staying for even years, always firmly trusting that the gods would remove the disease that they had imposed. Later on, when the ancient religions had died out, Church sleep took the place of temple sleep. The psychical effect of such temple and Church sleep would be much the same as that produced by sacred pools or springs, and the hope inspired by firm faith no doubt brought many nervous sufferers back to health who would otherwise have remained invalids. As in most things, fraud was apt to creep in in furthering the cures produced by such means, and Magnus relates how Henry II., a German Emperor, who suffered greatly from stone, retired to the Italian cloister, Monte Cassino, which enjoyed an immense reputation as a place of cure for such cases. During an acute stage of the royal patient's suffering, St. Benedict himself is related to have appeared in person and to have cut the patient for the disease, and then pressing the stone which he had removed into the hand of the sleeping emperor, retired to his heavenly residence, from whence he took care that the wound promptly healed.

The relation of astronomy to therapeutics dates from very early times and was specially strong in the dark ages. Hippocrates himself said: "Astronomy is not of slight but of very essential importance in medical art." According to the Babylonian code of Hammurabi, 2200 B.C., a surgeon who operated when the stars were unpropitious should have his hands cut off. All peoples seem to have at some time shown their belief in astronomy as affecting disease and its treatment, and it is hard to explain how such a widespread belief existed. With astronomy of such importance, almanacs and calendars were of great moment, and no medicine could be taken or operation performed without the sufferer's horoscope having first been cast and found to be propitious. We see traces of such belief to-day when people hesitate to start an

enterprise or journey upon a Friday, especially if this happens to fall upon the 13th day of the month.

Among civilized peoples the belief in the supernatural in relation to disease has largely died out, but amongst millions of the world's inhabitants it exists as strongly as ever, and in many parts of the world must be reckoned with by the modern practitioner as a powerful influence for good or evil upon the minds of his patients.

A great change and a lasting one came over the medical world when, in the fifth century, B.C., the Father of Medicine laid down the belief that disease was due to chemical, physical and other natural and earthly causes. Later, Galen disavowed all theism and relied solely upon physico-chemical methods, experiment and dissection. There was, of course, much bitter fighting between the two schools, that which considered all disease of natural origin, and the older one which viewed it as of supernatural source, but eventually a compromise was more or less reached in the form of Teleology. By teleology we understand the idea that "all earthly existence is created by a supreme power with a preconceived plan, and that, accordingly, all organic life in form and action is most perfectly adapted to the task prescribed for it by this power." At the same time it permitted the idea that disease was due to adverse purely earthly conditions, an assumption not involving the slightest doubt of the wisdom and creative powers of the gods.

Since Hippocrates placed Medicine upon a firm basis, theories in regard to the essential nature of disease have come and gone and whole systems of treatment have reigned for long periods, only to be completely replaced by others of often an opposite character.

Disease has probably not altered much since the beginning, and men have suffered much as their fathers did, but the science and even more the art of medicine have suffered much from bad theories—those deduced from insufficiently established facts, or those wholly evolved from the fantastic brain of some ill-balanced but influential individual and then pushed with vigour by his followers. Such unsound theories have led to extravagances and extremes of treatment that have done

much to stain the fair record of medical progress. Excessive bleeding, excessive drugging, the starvation of fevered patients from whom water even was withheld, are a few examples of what the public have suffered from systems of treatment founded on unsound theory.

Fortunately for mankind, theories are very often, so to speak, only skin-deep, and a sort of instinct, call it what we may, seems to have guided man aright. For example, the natives of South America had a theory or belief that cinchona bark drove away the evil spirit that was fever and ague. The idea that the disease was of supernatural origin was wrong, but the practice of giving cinchona for the relief of it was right. In the same way, iron was given in early times on the theory that it frightened away the spirits that produced pallor, and thus anaemia was treated. Now we have a different theory of how iron acts in such cases, but all along this drug has been used in the treatment of anaemic people. As an example of recent theory being wrong and yet the resulting practice being right, one might mention the belief that malaria was due to a miasma that did not rise high, and hence people built their houses on high ground or at least tried to sleep well above the marshes. Now we know that malaria is transmitted by mosquitoes and that these pests do not as a rule fly high. People had learned from observation, in fact empirically, that they were less apt to be attacked by malaria if they slept well above the marshes. This was a correct observation. Next the theory was evolved that the fever was due to a miasma. This was wrong, but the practice of avoiding the vicinity of marshes, especially at night, was right.

It will be found that nearly all theories in regard to disease have some element of truth in them, and when a system of treatment founded on such theories produces some good results it is well for us to carefully find that germ of truth and then to discard the thick husk of exaggeration, nonsense and even fraud that may surround and well-nigh hide this element of truth. Thus, in Homeopathy, in Christian Science, in the Emmanuel movement and in Couèism in recent times, as in

temple sleep, exorcism and in charms in times gone by, we see a nucleus of truth, which it will not do for us to ignore.

Homeopathy, with its infinitesimal doses, did a great service, coming at a time when the dosage of drugs, and strong drugs at that, had reached a dangerous pitch. By its means we learned what would happen when diseased persons were left alone; in other words, what was the natural course of untreated disease, and thus was discovered, or at least brought into more wide recognition, the *vis medicatrix Naturae*. Before that time it seemed to be assumed that disease would go on indefinitely unless it were treated. Yet Hippocrates taught that at least in acute disease there was a tendency to a natural return to health.

Now we know that the living body has marvellous powers of purifying itself from infection and poisoning and that the natural tendency is for most diseases to disappear; thus, although we cannot adopt the theory that drugs increase in power as the dosage is decreased, let alone the doctrine of curing like with like, still the element of truth that was made clearer by such practice was this tendency of the body to return to a state of health.

Evidence of the natural tendency to recovery is everywhere seen in the vegetable and animal kingdom. Generally speaking, the lower the organism in the scale of evolution, the greater and more complete is this tendency to restoration. A small twig, separated from the parent stem, will, when planted, grow into a new tree. If a *hydra* be cut in two its basal end will grow a new mouth, and its oral end another pedicle. One limb of a starfish can sometimes re-form the whole animal. Going a little higher in the scale, a lizard, when it loses its tail, simply grows another one, but the severed tail dies. In mammals the reparative process is not so complete, but if a portion of the liver of a cat or dog be removed, it will be largely and quickly restored. Such are a few examples of Nature's power of restoration of the tissues.

As regards functions, the body has similarly great powers of adaptation to disturbance, as seen when one kidney will take on the function of both and when in severe anaemia the yellow marrow of the long bones becomes red with its activity in producing red blood corpuscles.

The healing of an aseptic wound shows the natural forces all intent upon the restoration of the part. But it is important to remember that the power of Nature is not all on the side of the patient. The tissues and body fluids are provided with certain powers of fighting the bacterial invaders, but the invaders are also provided by unbiassed Nature with powers that help them. There are, from the patient's point of view, both good and bad forces of Nature, and it is only the former that constitute the *vis medicatrix Naturae*.

We may view Nature as the personification of the natural forces and realize that she is neutral and would as lief that the man die as that he survive the infection. When a cancer becomes implanted in the tissues, Nature encourages its growth, and nothing but the surgeon's interference will save the patient. In the same way, it is in accordance with Nature's laws that a tapeworm flourishes in the intestines or the *acarus scabiei* infects the skin. Both will continue indefinitely unless they are treated medicinally. Hence, while the physician must allow all natural forces that tend to help his patient to have full sway, it is often necessary for him to interfere with the course of Nature, and here we see the limitations of purely "expectant" treatment.

As Sir A. E. Garrod recently wrote: "We have come to realize that instead of commanding the forces engaged in the fight with disease, with the body of our patient as the battlefield, we are but his allies in the combat which he is himself waging against the enemies which assail and threaten to overwhelm him."

Nature may be compared to an absolutely unbiased judge, who dispenses the laws and exacts the penalties. And the laws are not human laws, but natural ones. A man poisons himself with alcohol and the court decides that he shall suffer and perhaps die. Another man shuts himself up in a bad atmosphere, and there, burning the midnight oil, wears himself out, working perhaps in order that his dependents may live. But the verdict is that the tubercle *bacilli*, which, following natural laws, have implanted themselves in his tissues, shall win. The court of Nature is indeed one where natural

¹*Lancet*, June 2nd, 1923, page 1093.

laws are inexorably administered, but one in which sympathy and pity are unknown.

But the practitioner is not unbiased, but wholly on the side of his patient. It is not an indifferent thing to him whether the cancer or the man win: whether the tubercle *bacilli* or the patient flourish. The sot may have broken both natural and moral laws, but he must be saved, if possible, in spite of his sins.

How then can the medical man best help his patient in his struggle back to health? In the first place, he must himself know the natural laws—the natural history of disease, just as a lawyer in order to help his client, must know the laws of the country. Then he must needs instruct his patient (or better still the man before he becomes ill) as to the consequences of breaking the natural laws. As J. W. Carr recently wrote, ¹“Not by constantly seeking short cuts to health, not by ingenious attempts to evade the results of law-breaking, not by merely tinkering with consequences rather than causes, can we ever hope to reach the ultimate goal of our ambitions and the final reward of our efforts—the genuine medical Utopia.” Although all men must eventually die, how much life and needless suffering could be saved by the instruction of the public in the simplest laws of health—the prevention of disease rather than the treatment of it!

The element of truth that underlies the undoubted results often obtained in temple sleep, the visits to sacred watering places, Christian Science interviews and the like, not to mention many of the “cures” which follow regular practice, is that the mind has a very great influence over the body, chiefly, to be sure, in so-called functional conditions, but to a certain extent in organic changes as well.

When the young doctor commences practice he will soon find himself inundated with samples of new remedies, always accompanied by attractive “literature” propounding the virtues of such drugs and giving medical evidence of their value. It is well for him to go warily in the use of such new preparations. All remedies must at one time have been new, and hence the fact of a drug being new is no argument against the possibility of its being even of great value, but as a matter

¹*Lancet*, May 19th, 1923, p. 993.

of fact, only a very small number of the new preparations that are so constantly launched upon the market, survive even a cursory trial. They turn out to be either of no use or are of less use than older similar bodies, or they prove to have some objectionable feature which soon condemns them to oblivion. All such new preparations should first be tried in institutions, where the effects can be closely watched. An old Edinburgh teacher used to advise his pupils to keep two years behind the times as regards the adoption of new treatment in their practice, and there was a great deal of sound sense in the advice.

To be critical of new things is not to disparage them. As Claude Bernard¹ said, "In science the word criticism is not synonymous with the word disparagement; to criticize means to seek the truth by distinguishing what is true from what is false."

Common sense is much needed in the handling of sick people. We must remember that the human body has marvellous powers of fighting against disease and that in most cases we are not treating the disease, but merely helping the body in its struggle back to health. As Sir Clifford Allbutt has said, "disease is not an entity but the reaction of the body to some infection or irritant." It is necessary for us to be modest and at the same time not pessimistic in regard to our power to help in this struggle.

Idiosyncrasy.—In many people, especially in those of a nervous temperament, certain articles of diet and certain drugs produce untoward effects. As regards food,—eggs, shell-fish and certain fruit, such as strawberries, may cause distressing and even dangerous symptoms, usually referable to the alimentary tract, as shown by vomiting or acute diarrhoea, or else to the surface of the body in the form of eruptions or oedema. I remember a student, some years ago, who, after partaking of some clam chowder, had much oedema of the head and neck, face, fauces and larynx, and for some hours it looked as if tracheotomy would be necessary. Exactly the same symptoms occurred in a young lad after eating blueberries. To some people eggs are a violent poison. It is not uncommon to find that asthma may be produced in pre-disposed persons by certain articles of diet that usually are

¹*Lancet*, March 10th, 1923, p. 411.

innocuous. Such food idiosyncrasy may be explained as being due to anaphylaxis. While these cases of idiosyncrasy towards articles of diet are often only too real, the practitioner will frequently find that people have ideas that certain foods do not agree with them, although no definite symptoms are produced. Particularly is this the case in regard to milk. In most patients it will be found, particularly if they are confined to bed, that a little persuasion is all that is necessary and the food will be digested well and will do nothing but good. Many of the laity's ideas about food are really founded upon theory rather than fact.

As regards Drug idiosyncrasies, we find two classes of peculiarities:—

(1) In the first class are those cases where symptoms caused by the drug are the ordinary ones produced by a toxic dose, only here they occur from a medicinal one. Thus, a pharmacopoeial dose of atropine may in some people cause symptoms of poisoning, and minute doses of calomel may produce in certain individuals severe diarrhoea.

(2) To the second class belong those in whom symptoms are produced by drugs which do not normally follow the administration of such, whatever be the dose. Thus, quinine may in some instances cause an itchy eruption and yet one does not usually see any eruption follow the use of quinine, however freely it be taken. Again, in a few people opium may act rather as a motor stimulant than as a narcotic. Not long ago, I saw a quarter of a grain of morphia given hypodermically to a hospital nurse produce symptoms resembling strychnine poisoning. She later told me that this had occurred before in the same way. Cats usually react thus to morphia, so there is a pharmacological explanation of it.

As in the case of foods so with drugs, the laity sometimes have an exaggerated belief that certain drugs do not agree with them, which sometimes is not the case. It may occasionally be necessary for the patient's good that the physician use a drug that he is anxious to give, without its name being revealed in the prescription. There are many examples of such preparations in the pharmacopoeia. Thus *Pulvis ipecacuanhae compositus* contains opium, as does also the compound soap pill.

CHAPTER II.

ROUTINE IN THE MANAGEMENT OF THE SICK.

In the physical examination of a patient, it has always been recognized that the best results are obtained if the examiner uses a certain routine in his work, and the one usually taken is that of inspection, palpation, percussion and, if necessary, auscultation. In exactly the same way, when the practitioner comes to the consideration of the treatment of the case he will find it useful to follow a certain routine. The one adopted here, and which I have always found of most value, is the following:

1. DIAGNOSIS.
2. ENVIRONMENT.
3. DIET.
4. REMOVAL OF THE CAUSES OF THE AILMENT.
(Radical or Specific Therapy).
5. SYMPTOMATIC TREATMENT.

By using some such method the physician's directions will be given in an orderly manner, and the tendency, all too prevalent, of immediately prescribing some medicine and often leaving the patient without further detailed instructions will be avoided. There are few places in the field of medicine, where system is more required than in treatment, and few where it is more often absent.

1. **Diagnosis.**—The first duty of the practitioner is naturally to try and find out what the patient is suffering from, and he must of course leave no stone unturned with this object in view.

Some diagnoses are apparently complete, for example, one of erysipelas, and yet even such an apparently complete diagnosis as this is by no means sufficient for the therapist. Thus, the patient may also have nephritis, due to the toxins of the infection or owing to some previous condition. The diag-

nosis of a case includes not only the recognition of some disease, but also the whole condition of the sufferer, the state of his resisting power, etc. Two patients are suffering from, let us say, erysipelas; the one, a previously healthy young adult and the other a broken-down alcoholic, with doubtful kidneys and thickened vessels. Our treatment must be quite different in the two cases, although they are both examples of erysipelas.

Some disorders are definite entities, but the young practitioner will soon find that most of his work will consist in the care of people suffering from slight disturbances of the various functions of the body to which it is hard to give a name. Yet these slight conditions are often very disabling and require treatment. It is usually easy to treat a condition early and difficult to do so when the disease has become fully established. It is early in the treatment of disease, as in the treatment of bad habits, that most may be done.

Many diagnoses pass through the three stages of possibility, probability and then certainty. For example, a patient may have fever, headache and some indefinite pains over the body. At the first visit a large number of possibilities will occur to the mind of the physician. His patient may have typhoid or paratyphoid; he may have influenza, or cerebro-spinal meningitis, or miliary tuberculosis, and so on. In a day or two the diagnosis will have been fined down to the probabilities of say typhoid or one of the paratyphoid infections, and a little later it may be quite clear that the disease is, say, typhoid.

Only too often, unfortunately, the diagnosis is uncertain until the condition ends in death or recovery.

When a man in previously perfect health, is taken with some acute disease, the diagnosis under a single name may be fairly correct. The patient is like a new motor car that suddenly breaks down. In all probability here there is only one lesion and when that is corrected the car will be as good as ever again. Most military medical work was among high category men, and the seeds of disease were thus sown in virgin soil; but in civil practice we are very often dealing with people who are not originally healthy, and when these are

taken ill with even the simplest of conditions, they are like old motor cars, which, when they break down at last, are found to have many weak spots besides the final trouble. In patients like these many systems are involved, and these facts must be included in the diagnosis.

We do not, or should not, diagnose a disease, but rather the condition of a diseased person, which is quite a different thing.

Two ships are out in the same storm off the same lee shore: one is sound in engines, spars and crew, while the other is weak in these essentials. The first will probably weather the storm and reach port safely, while the other may founder, or else struggle into the haven a mere wreck. So it is with the individual who is fighting against disease.

In endeavoring to diagnose the condition of a patient, a general view should first be taken of him, including the history and the surrounding circumstances of the case. Next we concentrate on any abnormalities found, bringing to bear on such all the methods of precision that are at our command. Finally in summing up the case, a general view should once more be taken, and then any abnormalities that have been discovered may be gauged in proper proportion to the whole "make up" of the man.

All "water-tight compartment" diagnoses must be avoided, under which heading may often be put diagnoses limited to single systems. Too great concentration on laboratory findings may sometimes divert our attention from the condition of the patient as a whole.

The special examinations have their place in clinical medicine, but they can seldom settle the complete diagnosis. A patient may show a positive Widal reaction, but the condition from which he is now suffering may not be typhoid, and the test taken by itself would lead us astray.

Many will remember when the von Pirquet test for tuberculosis was introduced. In time it was found to have a limited place in the diagnosis of this infection, but how many people were condemned to much mental and financial distress before that place was defined! Albumen in the urine does not necessarily denote nephritis nor sugar diabetes, and yet every day

one sees such unwarranted assumptions made upon such insufficient foundations.

Even when a diagnosis appears, according to our lights, to be clear, further pathological work in years to come may show that it was wrong. The history of medicine is full of examples of this, and yet how often is the treatment much superior to the diagnosis.

The diagnosis may be right and the treatment wrong, and yet the patient may recover. He gets better in spite of treatment, so strong in many cases is the natural tendency towards the state of health. In many cases all the practitioner can do is to place the patient in the best possible surroundings, feed him wisely, and relieve the symptoms as best he can, and then allow this great natural force to act.

The wise physician works along with and makes use of this natural force, and the less wise one thinks that he is curing the patient, and sometimes in his attempts to do this, combats the *vis medicatrix Naturae*, often with dire results to the patient.

When a man has swallowed some corrosive poison, vomiting quickly occurs, with the result that the poison may be ejected. The sound practitioner will encourage this natural attempt to get rid of the irritating material, or at least will not interfere with it; the less experienced one may give sedatives to relieve the vomiting and pain, and if he succeed, the poison will remain and work further mischief. Quite as definite examples of this tendency to interfere with Nature's endeavours are, or rather were, rampant in the practice of medicine. One such may be mentioned:—A fevered patient longs for water and it seems evident now that this craving is a natural one and that the water will help him to get rid of his fever, by increasing the sweat, inducing diuresis and so on. And yet for long periods in the history of medicine, under the sway of prevailing theory, water was forbidden to the fevered, much to the distress and suffering of these patients.

Hence, when we are considering how we can best help a sick man, let us always first think well of the natural history of the condition and to what extent and how the *vis medicatrix*

Naturae will act and then let our therapy all be such as to encourage those endeavours.

But it is possible to go too far in the direction of leaving the case to Nature, in other words, Expectant treatment. As has already been said Nature is not specially on the side of the patient. When a man carries a tape-worm, does Nature help him to get rid of it? In the same way, what tendency to cure is there in malignancy? Very frequently after the physician has fully studied the natural tendency to a return to health, he will find that much remains for him to do if his patient is to reach that goal, sometimes even to the extent of combating Nature, for Nature is careful of the race and careless of the individual.

II. Environment.—As soon as the practitioner has examined his patient, it becomes necessary to arrange for his environment. May he be allowed to go on with his work or must he lie up? Does he require skilled nursing? Should he be isolated? and so on. All invalids are better with abundance of fresh air, and in many cases, such as those of pulmonary tuberculosis, the colder it is the better they seem to do. At Gravenhurst Sanatorium it has often been noted that the patients do better in winter than in summer. Cold is stimulating to the surfaces of the body, including the respiratory tract, and thus reflexly no doubt has some tonic effect on the system.

In chronic conditions, when a climate must be decided upon, it is often found that the best is that one in which the patient has spent his early life. His body during growth had adapted itself to the environment of, say, a seaside atmosphere and hence later on if the man happens to live inland and is not well, he benefits by returning to the sea coast, and there placing himself in the (for him) natural surroundings. A mountaineer may pine by the sea, and a sailor fidget in the mountains.

The amount of exercise to be permitted or recommended will be discussed under the different conditions, but, generally speaking, it may be said that exercise is very essential for the well-being of every organ of the body, and that the more

exercise that is taken, short of distressing fatigue, the better. The patient's own sensations will usually here be the best guide, although in diseased conditions careful supervision by the medical attendant is very necessary.

Personality of the Physician.—The bearing of the medical attendant has a very powerful effect for good or for evil upon the patient. Many a successful medical man owes his success more to his manner and way of dealing with his patients than to any scientific knowledge that he may possess. Especially is this important when we have to deal with so-called neurotic patients, but the most stoical person is much influenced for better or for worse by the physician's manner and style of dealing with him. "What doctor possesses such curative resources as are latent in a spark of happiness or a single ray of hope?" pathetically asked the charming but neurotic French writer, Amiel. But surely it is the privilege and the duty of the doctor to give such sparks of happiness and rays of hope, and if he cannot do so, then he has mistaken his profession, no matter how skilled he may be in all the medical sciences. A few cheerful words, a hopeful view of the case expressed in the hearing of the patient or his friends, will often do more good than all the drugs that may be prescribed.

Even in such definitely organic diseases as cancer of the stomach one may see the cheerful bearing of a new practitioner called in to help, cause great improvement in the sufferer, to the extent even of causing him to put on considerable weight. Osler mentions such a case in his work (with T. McCrae) on Cancer of the Stomach, and I have had similar experiences.

The patient must have confidence in his doctor in order that treatment may be fully effectual, and if the doctor feels, as every practitioner occasionally does, that this confidence is missing, then it is far better for the patient, and for the practitioner, too, in the long run, that a change should be made. So much depends upon the hope inspired by confidence in the practitioner and his remedies.

All that a medical man learns in his intercourse with his patients must of course be kept secret. The question often arises, however, as to how much should be told to the patient

himself or to his near relatives. Generally speaking, a sick man has a right to know about his condition, but often the medical attendant will see that to tell him the unvarnished truth will only do him harm. In the first place, as has already been said, frequently the doctor does not know what is the matter, although he may suspect a number of possibilities, and it would never do to immediately tell the patient or even his near relatives all these suspicions.

Often the patient will worry his doctor for a name for his complaint and the practitioner can frequently satisfy this desire without unduly committing himself. Sir William Gull told of what great satisfaction the friends of a man suffering from some obscure disease had received when he assured them that the patient had cachexia! In military practice one would often see a soldier quite proud of such a diagnosis as "P.U.O." (pyrexia of unknown origin) or even of "N.A.D.", which means "no appreciable disease"!

When a patient is seriously ill and the practitioner does not feel that he should know, then it is always well to inform some near relative of the situation, both in order that the physician may protect himself and also that the friends may prepare for the worst.

It is sometimes the duty of the doctor to tell his patient that he should make his will, and if he be met by the anxious question:—"Then, doctor, am I going to die?" he can always give the old reply, "It is surely better to live prepared than to die unprepared. A man never yet shortened his life by making his will."

When the worst seems inevitable, the practitioner should still be very chary about giving up all hope. Such an action will almost certainly condemn the patient, already very ill, to a quick death. We are all liable to make mistakes, and it is not a rare thing to meet people who at least *say* that they had been given up by their doctors, and who are still alive and well years after. I can recall the case of an old lady who had been condemned to death by her doctor during a severe attack of pneumonia. In spite of this gloomy prognosis she recovered. The doctor then announced that at any rate she could not live through another winter. That was some years ago and the

old lady is still going strong, and another practitioner attends her!

Even when the end is very near, the practitioner should not commit himself to days or hours. "Will he live until next Sunday, doctor, as our son is in the West, and would come home if he thought that he could see him alive?" "Will he live until daylight?" Such are the sort of questions that are asked when the friends hear that there is no hope. And to all such enquiries the practitioner will do well to give very guarded replies. A good way and the true way to answer is to say that it all depends upon the resisting powers of the sick man. We may add that *probably* he will live until next Sunday or until daylight, as the case may be, but we have left ourselves a loophole and, after all, any more definite statement is mere guessing.

III. Diet.—A certain amount of food is of course necessary to meet the caloric needs of the patient; although, if he be in bed, then less nourishment is required than when he is up and about.

The body has always a reserve and can stand a certain amount of starvation for a short time without serious damage. Occasionally it becomes necessary to stop all food for a day or two, but so-called "starvation cures" for fevers of long duration and for other prolonged conditions should always be looked upon with suspicion. It was the great Irish physician, Graves, who asked that the epitaph upon his tomb might be "He fed fevers."

When for some reason the stomach will bear no food, nutrition may be carried on to a certain extent by other routes, notably the bowel, or by a duodenal tube, but such are only temporary and partial methods at best.

IV. Specific Treatment.—(Removal of the Cause). It is often a simple matter to remove the cause of some bodily trouble, and then the patient will quickly recover. Such specific therapy is seen when we empty the stomach of a poison or, by giving an anthelmintic, rid him of a tapeworm that may have caused ill-health for years. Again, in the administration of quinine in malaria, antitoxin in diphtheria and mercury in syphilis, we are more or less directly attacking the cause of

the trouble. Of a less direct but still similar nature is the use of vaccines, where we stimulate the production of antibodies. Specific therapy is the ideal one, and the number of diseased conditions that may thus be combatted is constantly growing, but it is still a fact that the vast majority of human ills are yet beyond such satisfactory method of attack.

Non-specific protein therapy should be mentioned here, where, by the introduction of a foreign protein into the blood, is brought about in some obscure way an increase in immunity towards various infections. Different proteins are used, the commonest being typhoid vaccine and peptone. After the injection of such into a vein the temperature of the body rises, a degree of leucocystosis occurs, and then an amelioration in the infection. The action is non-specific, in that the protein injected is not the same as occurs in the infecting agent. Thus, in a gonorrhoeal infection of a joint relief may be obtained by the intravenous injection of typhoid vaccine, and so on.

V. Symptomatic Treatment.—Here we endeavor to lessen the suffering of the patient and to combat symptoms that may in themselves threaten life or health, although we chiefly in the meantime rely upon the *vis medicatrix Naturae* to restore the patient to his normal condition. Yet, very often, by keeping up the strength of the patient by appropriate feeding or the use of stimulants, by saving him from the wearing effects of pain or of sleeplessness, we can so preserve him that the natural forces have time to act and he may recover, when otherwise he would have died.

The physiologist, Haldane, in writing of the administration of oxygen in inflammatory conditions of the lung, well says:—"It may be argued that such measures as the administration of oxygen are at the best only palliative and of no use, since they do not remove the cause of the pathological conditions. As a physiologist, I cannot for a moment agree with this reasoning. The living body is no machine, but constantly tending to maintain or to revert to the normal, and the respite afforded by such measures as the temporary administration of oxygen is not wasted, but utilized for recuperation."¹ The same thing

¹*Brit. Med. Jour.*, Feb. 10th, 1919.

may be said of many non-radical therapeutic measures. They keep the patient alive and give him time to recover.

A symptom is usually a link in a vicious circle, and if we can break that link then the patient may get well. A man has an eczema and suffers from pruritus which causes him to scratch, and the scratching increases the eczema. If the itchiness be lessened by appropriate sedatives, local or general, he will cease to scratch, and the eczema will have a chance to heal.

One sees the curative effect of symptomatic therapy when a surgeon sets a broken limb. His splints merely lessen the pain and mobility and then the natural healing forces have a chance to act. "I dressed his wounds, God healed them," was the modest and true reply of the great Ambrose Paré when he was congratulated upon having cured some patient. In the same way, when a physician gives bromides to an irritable and sleepless neurasthenic, he, so to speak, splints the jaded nerves and thus gives Nature the chance to act.

In symptomatic treatment drugs are chiefly used. It has often been said of drugs that they sometimes cure, often relieve, and always console, and there is much in the remark. What comfort, which cannot be explained pharmacologically, is often given by a bottle of medicine! and surely if the physician sees that he can give such comfort it is his duty to do so. I have never yet prescribed a bread pill, nor a bottle of coloured water, but one can see that such a pill or draught given with assurance and taken in faith might do good when such a result could not be attained in the absence of all medical treatment. It is a mistake to leave a patient for days without any treatment just because the diagnosis is not yet clear, or, indeed, because it is only too clear and believedly cannot be cured by treatment. Let it ever be remembered that we are dealing with human beings who are sick, rather than treating diseases. Moreover, there is always some symptom, such as sleeplessness, headache, constipation, want of appetite, and what not, which can be influenced for good, even if we do not yet know the full diagnosis nor can do much for the underlying disease. In hospital practice, especially, too much time is

apt to be spent over the pathological aspect of the case and too little over the question of what can be done for the sufferer.

Symptomatic treatment is sometimes thoughtlessly scoffed at (and rightly so, when anything more radical can be done), but very often it is all that is within our powers, and he is a bad physician, indeed, who does not then employ it. Even in mortal disease, such as inoperable cancer, the relief of the pain and distress will often not only ease the sufferer for the time-being, but will actually prolong life for weeks or even months.

But there is good and bad symptomatic treatment. As an example of the former, one might mention the relief of cough and pain in dry pleurisy by the use of opiates. Bad symptomatic therapy is seen when opiates are freely given to relieve a cough where there is much bronchial secretion. The patient's very life depends upon his coughing up the material and the opiate will lessen this cough and will also tend to weaken the respiratory centre. His bronchial tubes may thus fill up to the extent of suffocation.

Often, again, it is important not to mask symptoms until a diagnosis has been arrived at. This applies chiefly to acute abdominal conditions, where operation may be required. But, all the same, when it has been decided to operate, in any hours that may elapse between this decision and the operation, the pain and distress should be freely lessened by anodynes. This is sometimes forgotten, and such an omission may be the cause of much unnecessary and damaging suffering.

He is a gruesome physician who tells his patient that no treatment will do him any good. In the first place it is not true. By this it is not meant that we should always give medicines. Medical treatment is not necessarily medicinal, but includes every kind of physical, psychic, and other forms of therapy.

CHAPTER III.

SPECIFIC INFECTIOUS DISEASES.

THE GENERAL CARE OF FEVERED PATIENTS.

ENTERIC FEVER.

General Considerations.—By fever is meant a rise in the temperature of the body; the normal temperature of the human body is not a fixed thing, however, but varies within certain limits. 98.4° — 98.6° Fahr. is usually said to represent the normal temperature, and all clinical thermometers and most clinical charts have an arrow or a line at this point. But if the temperature of a number of healthy individuals be taken by the mouth, it will be found that it varies considerably, and on the whole tends to be rather below this arbitrary line. Some years ago I got my whole class to study their temperatures regularly night and morning for a week. These were always taken in the mouth and with due precautions as regards the recent taking of food or drink. The average temperature of the class proved to be 97.2° in the morning and 97.6° in the evening. A similar group experiment was repeated recently with the same result. Occasionally it will be found that an apparently perfectly healthy individual will persistently have a temperature below this; and, on the other hand, more rarely, the temperature may run at about 99° , and be for such an individual the normal.

On the whole one might define fever as a mouth temperature above 99° Fahr.

The regulation of the bodily temperature is not an absolute thing and is least apt to be so in children and in delicate adults. Some people have heat-regulating apparatus which are more easily disturbed than those of others, and it is well for the practitioner to remember this. The heat-regulating apparatus, which usually keeps the temperature of the body within normal limits in spite of great variations in the surroundings, may be diagrammatically represented as in figure I. The heat-regulating centre presides over, on the one hand,

the heat-producing centre, which governs the formation of heat by the burning of the body tissues; and on the other hand, the heat-dissipating centre, which in its turn presides over the vaso-motor centre, the sweat centre and the respiratory centre.

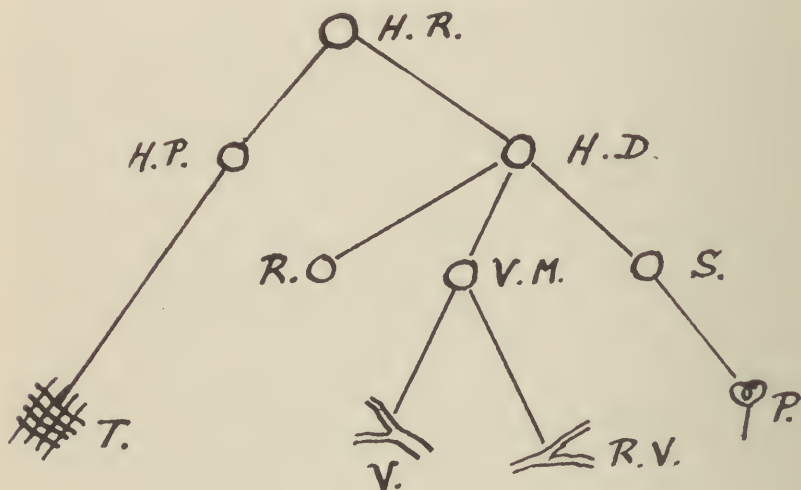


Figure I.

- H.R.—Heat regulating centre.
 H.P.—Heat producing centre.
 T.—Tissue cells.
 H.D.—Heat dissipating centre.
 V.M.—Vaso-motor centre.
 S.—Sweat centre.
 V.—Vessels of skin.
 R.V.—Renal vessels.
 P.—Sweat glands.
 R.—Respiratory centre.

If the surrounding air be cold, then the heat-producing centre becomes more active and more heat is produced. Also the heat-dissipating centre causes the vessels of the surface of the body to contract and the sweat glands to become less active and the breathing to lessen and thus the loss of heat is

lessened, while there is more of it produced, so the temperature is prevented from falling.

On the other hand, if the surrounding air be too warm, then the heat-regulating apparatus causes the production of heat to become less, the vessels on the surface of the body to dilate, the sweat glands to be active and the respiration to hasten, and thus, less heat being produced and more being lost, the temperature does not rise. In so-called cold-blooded animals this regulating apparatus is less developed, and consequently the temperature of these animals varies more or less with that of the surrounding medium.

Fever may be due to many different causes, but these always act through disturbances of the heat-regulating apparatus.

The most common cause of a raised temperature is the toxins of various infections. But fever may also be due to (a) excessive surrounding heat, where the regulating apparatus is unable to cope with the work thrown upon it, and may even become paralyzed when, quickly, great hyperpyrexia ensues (**heat stroke**); (b) or to chill, where probably the heat-dissipating centre is specially interfered with; (c) or to trauma, or disease about the base of the brain, which may paralyze the heat-regulating centre, and in consequence the temperature rises. One often sees such lesions followed by a temperature which exceeds all bounds and quickly proves fatal.

Thus, the rise in the temperature in fever is due either to increased heat production or to diminished heat loss. Very often both of these factors contribute. It has been found by much experience and experimental work that most fevers are chiefly due rather to decreased heat loss than to increased heat production, but in the so-called sweating fevers, where the skin is flushed and moist all through the course of the disease, the rise in temperature must be chiefly due to increased heat production. Rheumatic fever is a good example of this class.

In most fevers there are three stages:—(1) an early or cold one, where the temperature is high and yet the skin is pale and dry, and the patient feels chilly, and often shivers; (2) next, the hot stage, where the skin is flushed but still dry, and the patient feels hot; (3) and finally one where the skin is both

flushed and moist, and now the temperature rapidly falls. These three stages are best marked in tertian malaria, but are more or less present in most fevers.

By promoting the quick occurrence of these last two stages the physician can often hasten the return of the temperature to normal. He can also usually lessen the height of the fever and so save much discomfort, and damage to the tissues; and he may even thus save life, as hyperpyrexia can in itself cause death.

Diagnosis.—In many cases the exact nature of the fever is at first uncertain, and the patient must be treated upon general lines until such time as the diagnosis becomes clear.

Environment.—If there seem to be any likelihood of the case being of a contagious or infectious nature, the patient should be quarantined until it is quite clear that it is not so. Especially is this necessary in military and institutional practice. It is a good plan for the physician to wear a gown during his visits to patients suffering from any contagious disease, which gown can be conveniently left outside the door until the next visit. This will lessen the chances of him carrying infection to others.

Quarantine.—There is a good deal of doubt yet as to what length of quarantine is absolutely necessary in the various infectious diseases, but the tendency is to believe that it is somewhat shorter than was formerly supposed to be required. Still, the practitioner will do well to err on the safe side, and I give here the quarantine periods which are enjoined by the Public Health Act of Canada:

Scarlet Fever—	35 days, if no sore throat or nasal or aural discharge present.
Smallpox—	28 days, or when all scabs gone and lesions healed.
Measles—	14 days, if no cough or coryza remain.
Mumps—	21 days, if all glandular swelling is gone.
Diphtheria—	21 days, or less if two negative swabs are obtained.

Whooping Cough—	21 days after whoop develops.
Chicken Pox—	When all scabs are gone and lesions healed.
German Measles—	14 days.

The Incubation Periods are also important, as contacts must be kept quarantined until it is quite sure that they have not contracted the disease to which they have been exposed.

They are thus given in the Act:—

Scarlet Fever—	10 days.
Smallpox—	14 days.
Measles—	16 days.
Diphtheria—	7 days, or until a negative culture from nose and throat obtained.
Mumps—	18 days.
Whooping Cough—	14 days.
Chicken Pox—	21 days.
German Measles—	21 days.
Cerebro-Spinal Meningitis—	10 days.

These are, of course, the outside limits and the disease usually appears much sooner.

Where satisfactory proof is given of a previous attack of the disease the Medical Officer of Health may release contacts from such quarantine. The diseases to which this applies are whooping cough, mumps, anterior poliomyelitis, smallpox, scarlet fever, typhus fever and chicken pox.

The room in which the fevered patient is treated should be cool and well ventilated. It will be found that the idea still exists amongst many of the laity that fevered cases require to be kept very warm lest they take cold, and this is merely a survival of the former teaching of the profession. The patient should be kept in bed. It is a good rule that every case where the temperature is 100° or above should be so treated. The bedding should be light.

In continued fevers, that is those that will probably last for some time, great care must be taken that Bed Sores do not occur. Here skilled nursing is important, but the practitioner should himself see, by frequent examinations of the

back, that they are not threatening. The patient should not be allowed to lie in one position for long at a time, but must be frequently shifted to a new one. This is also important to lessen the tendency to hypostatic congestion of the lungs. The back should be kept scrupulously clean and dry, and it is well to have it powdered with a powder, such as one of equal parts of talcum and boracic acid, and after it has been wet in any way, to have it mopped with alcohol. Any red areas that occur should be painted with equal parts of white of egg and brandy, or flexible collodion may be used here. If sores do occur then all pressure must be kept off them by changing of posture and if necessary by the use of air-cushions or a water bed, and they are well treated with the powder mentioned. If deep, it is a good plan to clean them with boracic compresses, or a saturated solution of magnesium sulphate may be used.

But bedsores will seldom occur in cases of fever if the nursing be good. It is not uncommon to see them initiated by the application of excessive heat in some form.

Diet.—As has already been said, custom has changed here from time to time, and far be it from me to say that at present we have reached perfection. The digestive functions, like every other function of the body, are more or less in abeyance during fever, but as long as care is exercised, it is well to feed fevers freely. In this way, the great emaciation that otherwise occurs in continued fevers may be largely avoided. Fluids, and especially milk, are our mainstay, and the patient should have the equivalent of at least two thousand calories per day. If milk disagrees it may be modified in various ways. Thus, it can be peptonized or diluted with barley water or lime water. Milk tea or milk coffee will often appeal to a patient who has become weary of plain milk (page 47).

The patient should be allowed to drink all the water that he desires, either plain or in the form of lemonade or other fruit drinks. The Imperial drink is here valuable. It is made by dissolving a drachm of acid tartrate of potash in a pint of boiling water and adding sugar and lemon peel to taste. Grapes, grape fruit and other watery fruits are refreshing and may be taken freely. Water acts beneficially in fevers in several ways:—it increases perspiration and diuresis, drives

the blood to the surface of the body, and as it is itself warmed in the stomach, absorbs heat from the body. Probably it also acts by carrying off toxins from the blood by the excretions, but this action is not a pronounced one.

In serious cases of toxæmia where the patients are not being sufficiently nourished, daily subcutaneous injections of 500-1000 c.c. of isotonic glucose solution may be given, or one can give a hypertonic solution in quantities of 200-300 c.c. introduced slowly by a vein. The glucose not only supplies nourishment but also has a diuretic action.

Specific Treatment.—The diseases which can be specifically treated will be taken up later. It may merely be said here that often the cause of the fever can be quickly removed, as when we open an abscess, or remove toxins by free purgation.

Symptomatic Treatment.—Here we endeavour to reduce the fever and to relieve the symptoms that it or the toxins induce, while not directly attacking the cause of the trouble itself. Fever, in a way, is often self-limiting, in that the high temperature tends to make the body a poorer ground for the growth of germs, which generally flourish best at the normal body temperature. Still, there is no clinical evidence that by moderating a temperature we tend to prolong the disease, and it is not good practice to leave a fever case quite without treatment in the hope that the fever may kill the infection. The destruction of the germ is chiefly brought about by other factors, such as by the production of various antibodies, etc., and it behoves the practitioner in the meantime to make his patient as comfortable as possible. Still, he must not, in his enthusiasm, use remedies which may in themselves cause depression. Generally speaking, the practice is to use drugs in fevers that are not likely to last long, and in the continued fevers to rely chiefly on hydropathy.

Drugs act in the reduction of the temperature chiefly in two ways: Either (1) by lessening the production of heat, or (2) by increasing the loss of heat through the induction of sweating, flushing of the surfaces of the body, diuresis, &c.

Most antipyretic drugs act in both of these ways, though in different degrees. It is important to remember that while

many drugs will lower the temperature when there is fever, very few (and these only in large doses) will affect the normal temperature. Chloral hydrate and alcohol are the best examples of these latter.

Quinine will be more fully discussed under the heading of malaria, but it may be mentioned here that it has a decided action in most fevers and is much used for the purpose of the lowering of a high temperature. It has been shown¹ to actually increase the heat production, but, on the other hand, to so increase the heat loss that the total effect is antipyretic.

The Diaphoretics increase sweating in any of three ways:—(1) By dilating the superficial vessels, when the sweat glands are more freely supplied with blood; (2) by their salt action, where the total fluids in the blood are increased, and this causes sweating as it does diuresis, and (3) by a directly stimulating action on the sweat glands or the nerves. Pilocarpine is the best example of the last, but it is not used much.

The Nitrites belong to the first class: the only one used in fevers is the *Spiritus Aetheris Nitrosi*, the dose of which is from 15 to 60 mins. B. P., and 30 to 90 mins. U. S. P. This preparation owes its efficacy to the ethyl nitrite that it contains. The percentage of this should be (according to the B. P.) between 1.52 and 2.66 per cent. by weight, and in the U. S. P. 4 per cent., but it has been recently shown that much of the preparation that is on the market is too weak and even inert, so it is well to insist upon a recent preparation, as the strength is lost by keeping.

Another drug that acts by flushing the surface and producing sweating is Aconite. The B. P. dose of the tincture is 2 to 5 minims and the U. S. P. dose is 5 to 15 minims. They are of the same strength. Most authorities state that these doses also slow the pulse rate, but in an investigation on this point, some years ago, I was unable to detect any slowing even with larger doses than these. The work was done with a pharmacologically active preparation of the drug. The only way then that the drug slows the heart is by reducing the fever, and any fever-lowering body will so act.

Opium and Ipecacuanha belong to this class and are much

¹H. Barbour, *Can. Med. Assoc. Journal*, June, 1923.

used in short fevers, chiefly in the form of the *Pulvis Ipecacuanhae Compositus* (Dover's Powder), which contains one grain of each of these in ten grains, which is the ordinary dose for an adult.

As regards the class which act through their salt action, the best examples are *Liquor Ammonii Acetatis* (dose 2 to 6 drachms) and the Potassium Acetate, in doses of 15 to 60 grains.

Alcohol is a vaso-dilator and diaphoretic, as well as being a lessener of katabolism. The laity well know the value of a glass of toddy on going to bed at the commencement of a feverish cold.

The tar products (*page 446*) and the salicylates (*page 90*) are discussed later on: they are much used in fevers. The ordinary doses of them here are,—of the Salicylate of Soda ten grains every four hours; and of the tar products, Antipyrene (Phenazone) 5 to 20 grains, Antifebrin (Acetanilide) 2 to 5 grains, and of Phenacetin 5 to 20 grains.

Useful prescriptions in the symptomatic treatment of fevers are the following:—

℞ Spiritus Aetheris Nitrosi
Potassii Acetatis
Spiritus Chloroformi āā ʒiij.
Liquor. Ammon. Acetat. ad ʒvi.
Misce. fiat mist.

Sig. A tablespoonful in water every four hours.

℞ Quininae Sulphatis gr. j.
Phenacetini gr. ij.
Sod. Salicylat. gr. iiij.
Fiat Capsula. Mitte xij. tales.

Sig. One every four hours.

Or the plain Dover's Powder:—

℞ Pulveris Ipecacuanhae Compositi gr. x.
Fiat pulvis, Mitte j.

Sig. To be taken at bedtime.

When a patient is taking any drug that tends to dilate the superficial vessels or to cause sweating, he should remain in bed, as he is there less apt to take cold.

In continued fevers, as already said, the usual practice is to rely chiefly on hydropathy (page 51), but occasionally, when the fever is unusually high, drugs, especially quinine, are of temporary value.

ENTERIC FEVER.

The prevention of typhoid fever is beyond our province here, but it should be mentioned how largely the disease can be stamped out by careful attention to sanitation and by the use of typhoid inoculations. In the great War, this was well shown, and this fever, which usually haunts armies and kills more than the missiles and weapons of the enemy, was very nearly absent. The few cases that occurred were either in men who had missed inoculation, or else were of the mild and modified type which occasionally occurs even in the inoculated. The effect of inoculation becomes much less after a year, and it should then be repeated. The case mortality of typhoid increases with age, being about 9% in patients under 5 years of age, and over 30% in those about 50.

Diagnosis.—Every patient who is suspected of having typhoid fever (and here are included the paratyphoid types), should be treated as a typhoid case until we are quite sure that this is not the diagnosis.

Environment.—A suspected case of typhoid should be strictly a bed patient, and it goes without saying that this is also true when the diagnosis is confirmed. It is well known that ambulatory cases of the disease do badly, and also it is found, and was well shown in the Spanish-American war, that such patients stand travelling badly, and hence, whenever possible, should be treated where they fall sick. As regards bed, every case of this fever should be kept there until the temperature has been normal for ten days at least.

In military work typhoid cases are isolated and in civil hospitals they are more and more being treated apart from other patients. This is partly to lessen the danger of infection to others and also because it is easier to look after a number, who are having more or less the same kind of treatment, when

they are so congregated. In private practice it is not necessary to isolate the patient, but great care must be taken that his dishes be not used by others, and also that the excreta be disinfected before they are disposed of. The most effectual way of doing this is by the use of steam in special hoppers, but a more convenient method is to allow them to stand for several hours, in an equal bulk of one in twenty watery solution of carbolic acid, or one in a thousand of perchloride of mercury, before they are thrown into the latrine. All linen should be boiled before being sent to the laundry.

Diet.—The general aim in the feeding of typhoid patients should be to give as much nourishment as they can comfortably digest. In this way the nutrition is maintained and there is less weakness and emaciation towards the end. As already said, fashion has varied much in the dieting of such continued fevers. For long periods it was considered best to practically starve these patients and it was chiefly Graves' great work that altered the custom. But in recent years this idea has awakened somewhat, and occasionally one sees it recommended that typhoid cases should be given practically nothing but water for days on end. On the other hand, some enthusiasts have, as we believe, erred in the opposite direction, arguing that these patients can well stand almost an ordinary diet. The result of both of these extremes is far from reassuring. The happy medium would seem to be the best policy here as in so many things. The caloric requirements of the patient can easily be maintained by a fluid diet and this is more easily digested. My advice would be for the physician to rely chiefly on milk here. Six imperial pints of this per day, representing about 2400 calories, is by itself sufficient, but such a diet can be supplemented and part of the milk replaced by such things as milk soups, jellies, raw eggs, etc.

If the patient should weary of the plain milk, he can have milk tea, or milk coffee, where boiling milk replaces boiling water in the making. This little variation is often of great value. Or the milk may be peptonized. The objectionable bitter taste of fully peptonized milk can be avoided if the process is stopped by heat after ten minutes.

If there is any tendency to diarrhoea it is well to boil all the milk. Boiled milk has an astringent action on the bowels.

The patient should be allowed to drink freely of water and of all watery beverages. In bad cases, where toxæmia is marked and it is hard to properly maintain the nutrition and strength, alcohol is of value, acting here chiefly as a food. Half an ounce of whisky or of brandy may be given every four hours with benefit, and in severe cases much larger amounts may be used. Alcohol puts no strain on the digestive functions, and represents considerable caloric value. R. J. Wild¹ states that 100 grms. daily of alcohol can replace a chemical equivalent of fat. As much as 40 per cent. of the carbo-hydrate needs of the body can be supplied by alcohol, and still more when the patient is in bed. 1 gramme, as is well known, equals 7 calories, while 1 gramme of fat equals 9.3 and sugar 4.1 calories, respectively. It requires no digestion, and is quickly absorbed and oxidized, and can supply a large proportion of the total energy of the body. A low estimate of this is one-fifth, and some would put it much higher than this. Völtz & Deitrich calculated that in resting dogs 42 per cent. of the total energy needs was supplied by alcohol during a ten-hour experiment.

E. Mellanby² has recently shown that about 10 c.c. of alcohol is oxidized in the human body per hour, and recommends that when it is used in disease not more than this (and that well diluted) be given each hour. In this way as much as 1680 calories would be supplied in the twenty-four hours. Of course, such a dose would be very exceptional.

A more or less fluid diet should be maintained until the temperature has been normal for a few days, when, gradually, soft foods, such as thoroughly cooked rice, sago, tapioca and custard puddings can be added. Then bread and butter, and within two weeks he can be on a full diet.

Any indiscretion in diet is very apt to be followed by a return of the fever (the exact explanation of which is not yet clear), if not by serious complications of an intestinal type.

¹*Lancet*, Nov. 9, 1918, p. 623.

²*Brit. Med. Jour.*, Aug. 5th, 1922, p. 195.

Chewing-gum is often grateful to the patient and keeps the mouth in a healthy state and promotes the flow of saliva.

Specific Treatment.—Many attempts have been made to specifically treat typhoid by vaccines and sera, but so far without any definite benefit. We have tried vaccines in many cases, taking alternate patients, but without any good results, and in a few cases are not sure that the treatment did not do harm and cause haemorrhage and nephritis.

The place for vaccines is in the prevention of the disease. Certain drugs have been much vaunted as having a specific action here, but the results have not been encouraging or convincing. Many have believed that intestinal antiseptics were of benefit, on the theory that the infection was an intestinal one, but it has now been conclusively shown that the organisms that appear in the stools have come from the bile and are already on the way to destruction. The drugs mostly used for this purpose have been Salicylate of Bismuth in five to twenty grain doses, and Beta-Naphthol in doses of 3 to 10 grains, and lately Dimol (2-4 grs. t.i.d.)

Quinine certainly has a controlling effect on the fever, but can scarcely come under the heading of specific therapy.

Symptomatic Treatment.—When a sufferer from typhoid fever is kept in bed and carefully dieted, most has been done, but there are various symptoms that arise, which may be treated with benefit to him.

The bowels are often constipated, in which case it is best to use enemata of soap and water every day, or even only on alternate days. Early in the course of the fever it will occasionally be wise to use a single dose of Castor Oil or Calomel, but later on the enemata should alone be employed. Some practitioners use purgatives right through the disease, regardless of whether or no there be any constipation. Usually salines are here employed. This practice is founded on the assumption that the infection is an intestinal one and that the bacteria and their toxins can be removed by the purging. One of the chief objections to such treatment is the exhaustion that frequent movements of the bowel produce. Also, there is always the risk of causing haemorrhage and even perforation.

Diarrhoea is not common when the diet is carefully looked after, but if it occurs all the milk should be boiled. If this be not sufficient to control the flux, then bismuth and other astringents may be employed. (Page 342.)

Tympanites is best treated by turpentine stupes to the abdomen, or by the turpentine enemata, such as $\frac{1}{2}$ oz. of oil of turpentine in half a pint of mucilage of starch. A turpentine stupe is a hot fomentation, over the surface of which is sprinkled a teaspoonful of turpentine just before it is applied. In bad cases pituitrin in doses of 0.5-1 c.c. hypodermically is often of service.

Haemorrhage from the Bowel.—Sufficiently severe haemorrhage to require treatment appears in about 9% of cases. It usually occurs, if at all, late in the disease. It necessitates an immediate stopping of all food, and absolute quietness on the part of the patient, which can best be ensured by the use of morphia hypodermically. An ice-bag continuously applied to the right iliac region may have some value. I say continuously, because an ice-bag applied and left on until all the ice is melted and the water is warm and then refilled and reapplied must only stimulate peristalsis, which is just what we are trying to avoid.

If the bleeding continues, normal horse-serum, in hypodermic doses of 10 mils, may be used and can be repeated every four hours. Calcium lactate in 10-grain doses by the mouth is possibly of some value. Turpentine, given in capsules, each containing 3 minims and repeated every four hours, has been recommended by many.

Haemorrhage in typhoid is seldom itself fatal, although it is usually a sign of a severe infection, and hence the percentage of deaths in cases which have shown haemorrhage is much higher than the average. Yet the bleeding often seems to do good, as the temperature falls and with it the pulse, and the patient feels and is better. This has led to the suggestion that bad toxic cases of the disease might be benefited by a venesection, where the loss of blood can be accurately controlled. I have tried this in selected cases, and believe that it is occasionally of value. The indication would seem to be a profound toxæmia which cannot be lessened by other means.

Perforation of the Bowel.—This terrible complication occurs in about 3 per cent. of cases. It is usually ushered in by severe abdominal pain. When the diagnosis seems clear and a skilled surgeon is at hand, the sooner that the abdomen is opened the better. But even under the most skilled surgical care the mortality is extremely high—69 per cent. according to G. S. Armstrong and 92.5 per cent. in the hospitals of the Metropolitan Asylums Board.

Until the operation is done, and it should be done as soon as possible, every hour counting, or if it is not possible to do it, and this is not rare in certain localities, the patient should be kept well under the influence of opium and should get nothing except the drug by the mouth. Occasionally a case will recover under such treatment; I have seen two such. In another patient, who was very toxic, on several occasions we suspected perforation, and yet each time the symptoms went off and we delayed operation. Finally, he died of toxaemia, and at the *sectio cadaveris* several perforations of the bowel were found, which had each been sealed by layers of omentum or adjacent bowel.

But my advice would be to operate whenever perforation is diagnosed, if the services of a good surgeon are obtainable.

For the Fever some form of Hydropathy is usually required.

In mild cases, and in most ones in private practice, sponging is employed. The rule should be that the patient be sponged all over for ten or fifteen minutes every four hours, when the temperature is 103° or above. Water at a temperature of 70° Fahr. is usually used, but if the patient does not react well and remains cold and shivery after it, then water at body heat is often better. This is specially so in children.

The cold pack is another useful way of employing cold. Here the patient is wrapped in blankets wrung out of water at 70° Fahr. and he remains in the pack for twenty minutes.

A more severe way of applying cold is by means of the complete bath. Brand of Copenhagen introduced this method years ago and the treatment usually goes by his name. The patient is immersed in a bath at a temperature of 70° Fahr. every three or four hours, as long as his temperature is 102° or

above. While he is in the bath he is rubbed constantly. He stays there for twenty minutes. Where the method has been systematically carried out in large institutions, it has given a low mortality (about 6 per cent. as compared to the average of about 14 per cent.), but it requires much attention and is not, I think, so much used as it was a few years ago.

All cold hydropathy acts in several ways in lessening the fever:—(1) it directly cools the body by the abstraction of heat; (2) it causes diuresis and in this way some of the toxins are removed, but the chief way in which the cold acts is by (3) reaction. The vessels on the surface of the body are at first contracted, but they then reflexly dilate and the heat is consequently lost by radiation.

An ice-bag to the head has some effect in reducing temperature, and is especially useful in cases with much headache.

Toxaemia is the most common cause of death in typhoid.

The delirium and sleeplessness often require non-depressing nerve sedatives, such as the bromides (page 428). Morphine occasionally is necessary if there is much restlessness and insomnia, although it should not be used if the milder hypnotics will do. (Page 433.)

If the circulation tend to fail, strychnine, camphor and alcohol are indicated, and this last may be necessary in large doses, say 8 to 16 ounces in the 24 hours. In these toxic cases the question of a possible venesection should not be lost sight of.

The temperature in typhoid falls by lysis and the convalescence will occupy several weeks, during which time ample feeding and tonics are required. Relapses occur in about 10 per cent. of cases, but are not accompanied by so great a mortality as in the primary attacks.

The patient should not be discharged from medical care until the stools and urine are free from the bacilli. Occasionally a case remains a "carrier" for years and may be a focus of infection.

CHAPTER IV.

SPECIFIC INFECTIOUS DISEASES.

IMMUNITY. SMALL POX. DIPHTHERIA. TETANUS. SCARLET
FEVER. MEASLES. MUMPS. GERMAN MEASLES. CHICKEN-
POX. ERYSIPELAS.

General Outline of Immunity.—In any infection the disease is due to the invasion of the body by living organisms. Every such disease is caused by a special organism, which comes directly or indirectly from a previous case of the same disease. Pathologists have isolated and studied many of the organisms causing disease, but those involved in some of the commonest infections still elude detection. Thus we are still ignorant of the organisms that occur in measles, mumps, chicken pox, influenza, and many more.

When the body is invaded by micro-organisms it becomes the scene of a fight between the invaders and the invaded, and in most cases the invaded wins, and the disease thus comes to an end.

The symptoms of the infection are chiefly due to the reaction of the body to the toxins that come from the invading organisms. These toxins are of two kinds: (1) exotoxins, or (2) endotoxins; the former are excreted or secreted by the organisms, or produced in the surrounding medium, while the others only occur in a free state when the organisms are themselves broken up. Exotoxins are best seen in diphtheria and tetanus, and in most diseases endotoxins are the cause of the trouble.

When once micro-organisms have obtained an entrance into the tissues of the body, they would stay there and multiply indefinitely and the disease would never stop, except at death, if it were not that the body possesses a mechanism of defence, which either altogether prevents the invasion, or when it occurs enables the tissues to overcome the invaders and their toxins, and thus to neutralize their action.

At present there are four definite ways known in which the body thus defends itself, and no doubt there are others. (1) The tissues develop antitoxins, which neutralize the toxins of the disease; (2) Substances are produced, which directly attack and destroy the bacteria, or cause them to agglutinate; (3) Opsonins, which in some way increase the attraction of the bacteria for phagocytes, which then engulf and destroy them; (4) Phagocytosis, where the polymorphonuclear cells ingest and destroy the invaders; here they are assisted by the opsonins.

Immunity may be congenital or acquired. Most animals are immune to some diseases. Thus fowls are very resistant to anthrax, and dogs to tuberculosis. In the same way some human beings are immune to many diseases that attack certain animals, but we find also that certain people are more or less immune to certain diseases that attack others freely, and such immunity tends to run in families. Also people vary in their immunity to disease from time to time, and a man may be exposed to one infection again and again without taking it, and at last fall a victim. Any lowering of the general health tends to lessen immunity, and for this reason people usually die at last of what is called a terminal infection. It has been said with much truth that a man seldom dies of the disease that he is suffering from. Some terminal bacterial infection will finally carry him off, his immunity to such having been lowered by the original disease. It is usually pneumonia that thus acts.

Most therapeutic endeavour in the past has been directed towards thus raising the general resisting power of the body. Lately, however, much has been done in the way of increasing the specific resistance to special diseases.

If this raising of the resisting powers of the body is done in order to ward off a possible infection, then it is termed prophylactic; if it is done in order to help the body to more quickly get rid of the disease from which it suffers, then it is called curative production of immunity.

Acquired Specific Immunity is of two kinds:—

- (1) active.
- (2) passive.

(1) **Active Immunity.**—This may be acquired in many ways:—(a) by inoculation with a living virus of full potency. After this the individual is immune for some time to come. Formerly inoculation of small-pox was commonly done. A man would choose a time when he was in excellent health and when his affairs would permit of his laying up for a time, and then would be given the disease by inoculation. The results were surprisingly good, but the great objection to the method was that he became a source of infection to others, who, perhaps, might take the disease virulently, owing to their resisting powers being low at the time. (b) Inoculation with an attenuated virus. Vaccination for small-pox is the best example of this method. Here the virus has been attenuated by its passage through the tissues of a calf and the resulting disease is much milder than the original one, and yet stimulates the tissues to the production of antibodies nearly as well. (c) Inoculation with a dead virus or extracts from such. This is the nature of the various vaccines now used, of which typhoid vaccine and tuberculin are good examples.

Lately, it has been found by Besredha that a degree of immunity to certain infections can be attained by vaccines given by the mouth. This has so far been done in the case of Shiga Dysentery and Malta Fever.¹

In all these instances of active immunity, the tissues are stimulated to produce antibodies which attack the invading bacteria or their products. Active immunity usually lasts a long time,—it may be for years as in the case of small-pox, or for months, as in typhoid.

Many drugs, of course, produce active immunity, as quinine in malaria and mercury in syphilis.

Recently it has become evident that vaccines and sera, confer a certain degree of non-specific immunity. For example, typhoid vaccine may greatly benefit those infected with other diseases; even the intravenous injections of non-bacterial materials, such as albumose or peptone, seem to act in the same way. After an administration the temperature rises, and frequently a rigor occurs, and, following this, the infection—be it local as arthritis or general as typhoid fever, tends to

¹*Lancet*, October 28th, 1922, p. 921.

improve. The action here has been ascribed to so-called "protein shock."

(2) **Passive Immunity.**—Here we take the blood serum from an animal that has been actively immunized against some disease, and inject it into the patient. The serum contains the various antibodies that had been produced in the body of the animal for its own protection. These antibodies merely neutralize the toxins of the invading bacteria, or destroy the bacteria, and as soon as they are excreted from the body the immunity ceases. The best examples of the production of this passive immunity, is the use of antitoxin in diphtheria. Diseases that are caused by organisms producing exotoxins are more amenable to this passive immunity than are others. Passive immunity does not last long, and is chiefly used for curative treatment. It, however, confers immunity against infection for a short time, and thus is used as a prophylactic against diphtheria, and several other diseases, especially tetanus.

SMALL-POX.

This disease used to be one of the scourges of the world. It was considered to be a children's disease because very few people lived beyond childhood before they were infected. The mortality from it was high and nearly everyone was pock-marked, as few escaped the infection. When death occurs in small-pox it is usually due to a secondary streptococcic infection. The only specific treatment that had been used was inoculation. But in 1796 William Jenner introduced vaccination and since then the disease has lost its hold on mankind, and is now a rare thing. Whenever vaccination is systematically neglected in a community, however, the disease breaks out with all its old virulence. This was notably seen in the historic Gloucester and Leicester epidemics, and then at Montreal, where, following the neglect of vaccination, there were 3,164 deaths from small-pox in 1883. In the German army vaccination reduced the death rate from small-pox from 36 per 100,000 to 3, and now has absolutely abolished the disease; and in the allied armies in the recent war the

disease was practically absent. In most civilized countries vaccination is now compulsory.

Jenner made his great discovery by observing that dairymaids who had suffered from sores on the hands, supposed to be due to milking of cows with sore teats, were immune from small-pox. He extracted a serum from such sores and inoculated human beings with it, and this was vaccination.

Cow-pox is believed to be small-pox modified by its passage through the body of the cow. In man it causes a local infection at the site of the introduction with some general symptoms and then immunity to the graver disease is produced.

Methods of Vaccination.—The old method was by means of arm to arm vaccination, but this had obvious objections and now the use of calf lymph has become universal. When vaccination is done on the leg the sores nearly always give rise to trouble unless the individual will consent to stay in bed during the acute phase.

The upper arm should be used. The area selected is cleansed with soap and water, and then with 70 per cent. alcohol, which should be given a few minutes to evaporate. Then with a special needle the skin should be gently scraped so as to remove the cuticle without causing bleeding. Now the lymph is dropped on these surfaces and gently rubbed in with the side of the needle. Allow it to dry and then apply a pad of aseptic absorbent and a bandage. It has been found by much observation that four marks are better than three, and three better than two, and two better than one. Each mark should be about one centimetre square. On the eighth day remove the dressing and redress. The marks, if the vaccination has "taken", will be swollen and red, and tending to have blebs. It is best now to dust on some antiseptic powder, such as boracic acid or acetanilide, and replace the dressing. In another week this dressing can be removed, and a smaller one put on as required. The arm should be completely healed in a month. The common cause of bad arms is sepsis and this is generally due to after-infection. This danger may be avoided by the keeping of the areas covered, as one would a surgical wound.

A subcutaneous method of vaccination has recently been advocated. It seems to give a higher percentage of "takes" and there is less danger of a secondary infection. A small amount of diluted vaccine is injected into the skin with a hypodermic syringe.¹ This method has recently been thoroughly tested at the Guindy Institute in India and is found to produce a certain degree of immunity, but this is not believed to be very lasting², and as the British Medical Journal says in an annotation³ we must be very sure of its value before substituting it for one that has stood the test of 120 years.

If the vaccination does not take it may be due to the lymph being inert, or to the fact that the patient has so much resistance to the infection that he escapes. In the latter case he may probably be assured that he is for the time-being immune to small-pox as well. The immunity conferred by vaccination lasts for many years, but it is better to repeat the little operation every seven years, and even more frequently if there be much danger of infection.

As regards the care of cases of small-pox there is little of special value that need be said. The patient must be quarantined and the quarantine kept up until the skin is quite free from all scabs, and, indeed, quite normal again. Every one in attendance should be vaccinated and all those who have been exposed to the diseased person, as vaccination protects even if done some days after exposure.

The patient should have the general treatment for continued fever. (q. v.)

Early severe pain in the back may necessitate the use of antipyrine or phenacetin (10 grains), or even morphia. The eruption requires care, especially on the face, where after-marks are specially objectionable. If seen early, before the pustules form, it is well to paint each one of the papules with collodion. This protects them and prevents secondary infection. If they are pustular then wet applications, such as a solution of carbolic acid

¹*Journal of American Medical Association*, 1918, Vol. 2, page 654.

²*Lancet*, July 30th, 1921, p. 243.

³*Brit. Med. Journal*, Dec. 9th, 1922.

(1-100), or of corrosive sublimate (1 in 5.000) are perhaps the most useful, or the pustules may be painted with iodine. Pricking of the pustules is not advisable. The eyes are apt to be inflamed, and even the eye-balls ulcerated, and careful attention here may do much to save them. Drops of semi-saturated boracic acid solution are useful. Various light treatments have often been advocated for the treatment of the eruption, but the results are uncertain.

Complications, such as broncho-pneumonia, neuritis, nephritis, vomiting and diarrhoea must be treated as they arise. The death rate in different epidemics has varied enormously, from 1.4 to 55 per cent. The mortality in cases modified by vaccination (varioid), is almost nil.

DIPHTHERIA.

All people are not susceptible to the infection of diphtheria. This is very evident from everyday experience, and the Schick skin test shows that children from 2-12 years of age are most liable to the disease and that a large percentage of persons of more mature years are immune.¹

The modern treatment of this dreaded disease is a triumph in scientific therapy. Just as vaccination for small-pox is the best example of prophylaxis, so the use of antitoxin in diphtheria is the best one of curative treatment. But to take the subject in order:—

Diagnosis.—The diagnosis of diphtheria may sometimes be made with certainty immediately, especially when an epidemic is raging, but usually it is necessary to have it confirmed, and often made, indeed, by the report on swabs taken from the inflamed area in the throat or nose. Sometimes a direct smear may give the information that we want, but more often it is necessary to wait for the growth of a culture. But let me emphasize this point:—Every suspected case of diphtheria should be treated as one of the disease, until such time as it is quite certain that it is not of this nature. By following this rule the practitioner will do no harm and will often save life, and also prevent the spread of the disease. For it

¹*Lancet*, January 7th, 1922, p. 60.

is early in the infection that the special treatment is most valuable.

Environment.—Every suspected case should be isolated. When the diagnosis is confirmed then this quarantine must last as long as there is any infection in the throat—the usual rule is until he has had two successive negative swabs. One is not sufficient, as the bacteria may be missed on a single occasion. Most commonly it takes about six weeks before the throat becomes bacteriologically free, but it may be much longer. The patient must not only be in bed, but kept horizontal, as heart failure may occur. At the Paddington Hospital for Sick Children, some years ago, all diphtheria patients were kept tied down in bed on account of this danger. When recovery has taken place the effect of getting up must be carefully watched.

The attendants and all those who have been in contact with the patient, or who have even been in the same house with him, should be given prophylactic doses of antitoxin; 1000-2000 units is usually sufficient here. The effect of this lasts for about three weeks. The throats of those who have been in contact with a case should be bacteriologically free from infection before they are permitted to again enter ordinary life.

Diet.—There is nothing special to note about the diet. It should be fluid and as ample as possible. In those exceptional cases where swallowing is impossible owing to throat involvement rectal feeding may be required for a short time.

Specific Treatment.—Since the introduction of antitoxin the death-rate from diphtheria has been greatly reduced. From all parts of the world the same success has been reported, and nothing in therapeutics is more certain than its value. In Paris, for example, the mortality from this disease fell from 62.2 per hundred thousand to 13.3. In Ontario the deaths per 100,000, at ten-year intervals, run as follows:

In 1880	there were	66	deaths from	diphtheria.		
In 1890	“	“	42.6	“	“	“
In 1900	“	“	33	“	“	“
In 1910	“	“	17.9	“	“	“
In 1918	“	“	12	“	“	“

The return for 1918 was the lowest since 1870, although the population of the province has more than doubled, and moreover the incidence has for some reason increased, but this increase has been met by the free distribution of antitoxin.

No doubt even these figures could be greatly improved if the two rules were constantly followed of (1) giving antitoxin early, and (2) giving it in sufficiently large doses.

The value of the first rule is well supported by the returns of the Philadelphia case mortality (1910-14), as follows:—

Antitoxin					
given on	1st day	2nd day	3rd day	4th day	5th day
Mortality	1.1%	5.6%	6.8%	7.7%	9.2%

Some years ago I published in the British Medical Journal a series of 42 consecutive cases of diphtheria treated in the Victoria Hospital for Sick Children without a death. Every case was confirmed bacteriologically, but they had all occurred in the hospital, so were treated early with antitoxin. As already said, in a doubtful case of the disease the practitioner should not wait for the laboratory report before giving the remedy. It is infinitely better to occasionally give it where it is not required than ever to miss giving it where the disease is diphtheria. When the laboratory report comes, perhaps in a day or two, and is positive, then he will have the satisfaction of having stolen a march of a couple of days on the disease; and if the report is negative, he will have done no harm, and indeed, good, for other infections of the throat are often favorably affected by antitoxin as well as diphtheria, although, of course, not to the same extent.

Antitoxin is procured from horses, which have been actively immunized by repeated injections of the toxins of the disease. The serum of the animal's blood is now heavily charged with antibodies, and when injected into a patient tends to produce a passive immunity. A *unit* of antitoxin is one hundred times the amount of it which will just neutralize a fatal dose of toxin for a guinea pig.

The serum is best injected, under ordinary antiseptic precautions, below the skin between the shoulders or on the abdomen. No preliminary anaesthetic is required. By giving

antitoxin intramuscularly it more quickly reaches the general circulation, and this has been the routine method in the Edinburgh City Hospital for years.¹ In desperate cases antitoxin may be given intravenously. It is interesting to note that Poul Iversen of Copenhagen has recently urged the intravenous method as a routine one and supports his plea by much clinical evidence.² Unfortunately a special antitoxin, containing less antiseptic than usual, is here needed.

The prophylactic dose of antitoxin is from 1000 to 2000 units, but for purposes of treatment much larger amounts than this are necessary. Lately, toxi-antitoxin has been much used as a prophylactic. According to W. H. Park,³ three injections produce complete immunity, as tested by the Schick test, and lasts at least three years. The method seems free from risk and is recommended for all children showing a positive Schick reaction and also for adults who are likely to be exposed to the infection.

The dose of antitoxin varies with the age of the patient. Schick believes that an average dose should be 100 units for each kilo of body weight, but in severe cases as much as 500 units per kilo may be required. In a case of moderate severity, the first dose should be 10,000 units and this amount may be repeated every eight to twelve hours until improvement sets in, and then less frequently, as long as there is any fever. The British Ministry of Health gives 8,000 units as the minimum dose at any age. In urgent and severe cases much larger doses than this should be employed. I recall one case, an adult, seen some years ago; the patient had been ill for several days and had all along had small doses of antitoxin. The disease had extended down into the larynx and threatened her with suffocation. Tracheotomy, or at any rate intubation, seemed necessary, but before resorting to either of these we gave the patient 30,000 units of antitoxin and followed it with other doses not so large. In eight hours she was much better and soon after coughed up a diphtheritic cast of the air passages and in a few days was completely well.

¹C. B. Ker. *Lancet*, April 28th, 1923, p. 871.

²*Lancet*, April 7th, 1923, p. 694.

³*Medical Record*, 1919, II, p. 900.

There are, of course, certain drawbacks to the use of antitoxin; in a few instances sudden death has followed a single dose, due to anaphylaxis. These accidents have usually occurred in asthmatics. In these it may be probably avoided by giving 0.5 to 1 c.c. of serum hypodermically, half an hour before the main dose, with the object of producing desensitization. If symptoms of anaphylaxis threaten, a hypodermic of 1/100 gr. of atropine sulphate is of value. For over fifteen years every child in our Children's Hospital was given a prophylactic dose of antitoxin every three weeks. This meant many thousands of doses, and yet we never had any severe trouble following it, much less a death. A certain amount of fever is common after antitoxin. Pains in the joints and locally at the point of injection are frequent, and eruptions of the erythematous and urticarial types often occur. Calcium lactate in ten-grain doses appears to give some relief in these serum phenomena.

Symptomatic Treatment.—If a case of diphtheria has been given antitoxin freely and early there will usually be little need for other treatment, but the practitioner may have to treat certain symptoms. If there be much membrane in the throat and nose, sprays of some antiseptic, for example, peroxide of hydrogen may be of value. Swabbing, gargling or douching are more effectual than sprays, but often more difficult to carry out, especially in young children. Warm normal saline solution or a saturated one of boracic acid do very well for this purpose. If the young patient fights against such local treatment it is often better to omit it altogether. If the membrane invades the air passages then tracheotomy or intubation may be required, although even here massive doses of antitoxin are sometimes sufficient. In hospitals, intubation is the more common operation, but the patient requires closer watching than after tracheotomy and so the cutting operation is oftener the best to employ in private practice.

When toxæmia is great, alcohol is of value and should often be pushed. Cardiac failure and diphtheritic paralysis are the worst sequelæ. The latter usually appears during convalescence and may for a time be progressive. Heart fail-

ure may occur progressively during the fever, or suddenly appears in convalescence, this being specially the case if the patient has exerted himself too soon and greatly. It is on this account that he should be kept horizontal during the illness and only very slowly allowed to return to normal activity. Most practitioners have had the tragic experience of the sudden death of a patient after he seemed to be out of danger.

Perchloride of iron, in doses of 10 to 15 mins. of the tincture, or liquor, is believed by many practitioners to be of value in diphtheria, and at least can do no harm, and is astringent and tonic.

Wound Diphtheria.—Wounds occasionally become infected with the diphtheria bacillus, and many examples of this occurred during the War. The condition appears to be a peculiarly localized one, and few general symptoms are present. Antitoxin is here not of much value, but the condition will generally clear up very quickly under the application of tincture of iodine.

TETANUS.

This disease is usually rare in civil practice in Western countries, but in the East it is very common, and in China a large proportion of the infants die of it owing to the septic manner in which the umbilical cord is separated, and also much of it was seen in military practice. It is an infection which is much easier to prevent than to cure. By Army orders every soldier who had been wounded was, as soon as possible, given 500 U. S. units of antitetanic serum. In this way enormous numbers of cases of tetanus were undoubtedly prevented, as the soil of France and Flanders swarms with the tetanus bacillus and early in the war, before the rule of giving the serum was general, many cases occurred. In civil practice the same routine should be followed where wounds have been contaminated with dirt from roads or gardens, and it is well to repeat the dose 2 or 3 times at weekly intervals.

Diagnosis.—This is easy when the disease is well developed, but any stiffness in the muscles around a wound or elsewhere

should be an indication for treatment, as the earlier this is commenced, the more likely is it to succeed.

Environment.—It is not strictly necessary to isolate a case of tetanus, but it is better to do so for the patient's sake, as thus quiet is more certainly obtained. The room should be moderately warm and free from draughts, as any sudden chilling of the surface of the body may bring on the spasms. Also the room should be darkened, as bright lights act reflexly in the same way.

Diet.—The diet had better be fluid, as it is thus easier to swallow, and also the patient probably has high fever. It may in some cases be necessary to feed through a soft catheter passed between the teeth or through a nostril. When swallowing is impossible, occasionally an anaesthetic may be used and a full meal given by the stomach-tube.

Specific Treatment.—Antitetanic serum has been very extensively tried during the War, and on the whole, has proved to be of some value in treatment, although its great use is in prophylaxis. The toxin of the disease very quickly enters into combination with the nerve cells and then the serum does not touch it. A unit here is the amount of the serum that will neutralize a thousand fatal doses of the toxin for a 350 gramme guinea pig when the two are experimentally injected at the same time. The earlier and the larger the doses of the serum, the better the chances of success. It may be given intrathecally, subcutaneously, intramuscularly or intravenously. Often several of these routes are employed at the same time. In an average case 3,000 units should be given intrathecally and 5-10,000 intramuscularly. This is usually repeated daily at first, and then less frequently. The report by Sir W. B. Leishman and Major A. B. Smallman¹, states that the best method is the intramuscular one, then the subcutaneous, both as near the wound as possible, then intrathecally, and lastly, intravenously. Both the last are here said to be dangerous. The dose should be 10,000 units, repeated daily. Others will give 3-5,000 units intrathecally, and the same amount intravenously and also intramuscularly all at one time.

Carbolic acid injection, introduced by Baccelli years ago,

¹*Lancet*, 1917.

has been largely tried and has many advocates. In 1914 Sir Purvis Stewart¹ published a summary of recorded cases of tetanus, in which this treatment showed a mortality of 17.4 per cent., while the others, not so treated, showed one of 61.9, to 78.9 per cent. It is only fair to say that in many men's hands the results have not been nearly so good. Baccelli gave .3 to 1.5 grams of the acid daily, always watching the urine. He published 190 cases (excluding those of slow invasion and mild convulsive attacks), and divided them into two groups—severe and very severe. Of the first there were 94 cases and 92 recovered, i.e., a mortality of 2.12 per cent. In the second there were 38 cases, with 16 deaths. In eleven of these the daily doses were below .5 grammes. He therefore excluded these and claims a mortality in the remainder of 18.5 per cent.²

The method is to inject 1 c.c. of a five per cent. watery solution of the acid into the abdominal wall every two hours for a time and then less frequently as the symptoms abate. The urine should be constantly watched, and if any darkening occurs the treatment should be stopped, but it is wonderful how much of the drug these patients will stand without any toxæmia. Personally, from a small experience, I think the method is of some value, although it should never be used to the exclusion of the serum.

It may be added that Sir David Bruce in 1915 gave a summary of the treatment of 231 cases with a mortality of 57.7 per cent. with the conclusion that the therapeutic effects of both the serum and the carbolic acid were slight.³

It should be mentioned that there are a number (probably four) strains of the tetanus bacillus, and the serum to be fully effectual should be from a horse inoculated with the right strain: or a polyvalent serum must be used.

Symptomatic Treatment.—The purely symptomatic treatment of tetanus is often very important for the relief of the suffering, and no doubt, in some instances, brings about a cure which otherwise would not have occurred. Chloral hydrate, ten grains, by the mouth, and double this quantity per

¹*Brit. Med. Jour.*, II, 1914, page 1098.

²*Brit. Med. Jour.*, II, 1915, page 593, and *Lancet* of same date.

³*Lancet* 1, 1911, page 1714.

rectum, is much used. It lessens the severity of the paroxysms and may be repeated as often as every four hours. Chloretone can be used in the same way, and in similar doses. Bromides act less powerfully, but often are of value. Magnesium sulphate has been a good deal used in the condition, and if given freely enough will relax the spasms. The drug may be given subcutaneously in a 1 or 2 per cent. aqueous solution (10 c.c. every 4 hours), or the special method of Meltzer can be tried. Here a 6 per cent. solution is slowly given intravenously until the respiration tends to weaken. A 2 per cent. solution of calcium chloride must be at hand, and this is similarly given if the respiration tends to cease. This method is not recommended by Meltzer as a routine one, but only when asphyxia threatens from the severity of the spasms. Still another way of using the magnesium sulphate is to inject it in 25 per cent. solution intrathecally (using 1 mil for every 25 lbs. of the body weight). This treatment is capable for a time of abolishing all clonic and tonic spasms, but must be used with great caution.

Morphia will often have to be used in severe cases. Occasionally a little chloroform is valuable when the paroxysms are urgent. As regards the treatment of the offending wound it is generally believed that this should be cleansed surgically, as far as possible, although it should be noted that Sir William Leishman says that once the spasms have set in more harm than good will proceed from this.

Before any operation on a war wound is done, even many months after its infliction, a dose of antitetanic serum should be given, as the tetanus bacillus may be still lurking there, and the disease may be lighted up by the disturbance. Many cases are on record where this has happened a year or more after the original wound, but by far the longest that I have come across is one recorded by H. E. Clutterbuck, where an officer was wounded in September, 1916, and developed tetanus after a ride in January, 1919, 865 days after the wounding.

SCARLET FEVER.

Scarlet fever is a disease that specially affects children, and ninety per cent. of the deaths from it occur before the

tenth year of age. Epidemics of it vary enormously in virulence, some being attended by a very low mortality, while others are the reverse. The disease is characterized by fever, a scarlet eruption, sore throat and a tendency to nephritis.

Diagnosis.—In epidemics this is usually an easy matter, but sporadic cases are apt to be missed if the symptoms are not characteristic, as is sometimes the case. During an epidemic we often see most atypical cases, for example, ones without any rash, and others with perhaps scarcely any fever, and such, when they occur sporadically are very apt to be missed. Moreover, some toxic rashes occurring in sepsis or after certain drugs, such as belladonna, quinine and iodide of potash may cause confusion.

Environment.—Whenever scarlet fever is even suspected the patient should be isolated until the diagnosis is clear, and then if this be positive, the quarantine can be continued, and if it be not positive, the day or two of isolation will have done no harm. Such temporary quarantining of suspected cases is always wise, but specially so in institutions and in military practice. It will save the occurrence of many an epidemic. The same remarks apply to all suspects of infection, but to none with more force than in the disease under consideration. But one word of warning here,—a suspected case of, say, scarlet fever should not, during the period of observation and until the diagnosis be clear, be put in the same room as real cases of the disease. I have known this to be done and then, after the usual period of incubation, the patient, who really did not have the suspected disease at first, now shows it. Such a mistake is a very grave one, and would very properly lay the physician open to severe criticism. In military practice it is usual to have observation wards for such suspected cases as well as isolation wards for declared cases of the disease.

The quarantine in scarlet fever must be very strict, as the infection is carried not only by attendants, but in articles of clothing, books, letters, dishes, etc., and certainly by milk. All dishes and everything coming from the sick-room should be disinfected by heat or by soaking in a 2.5 per cent. solution of phenol.

Scarlet fever is most infectious during the first few days

of the illness, but is more or less so for about five weeks, and this is hence the period of quarantine, and even then the patient should not be released if there be any discharge from the ears or nose. The infection seems to be chiefly in the secretions from the nose and throat, and is probably not in the scales from the skin unless these are contaminated from this source.

The sick-room should be comfortably warm (about 65° Fahr.), but with free ventilation and plenty of fresh air. The patient should be kept in bed while there is any fever and for at least a week after this has left him.

Diet.—During the period of fever the diet should be entirely fluid and principally one of milk, with lots of water and watery drinks. Seeing that there is so frequently some albuminuria, if not more serious kidney irritation, it is well to keep the proteins low. Fruits are a pleasant addition.

Specific Treatment.—As a routine treatment vaccines are not required, but in the angina which may complicate scarlet fever an autogenous vaccine prepared from the patient's throat may be of some value, especially in the more chronic form of the condition. The value of a stock streptococcic vaccine is very doubtful. Antistreptococcic serum may help in these bad throats and is more rational than the vaccine in such acute conditions. Diphtheria antitoxin is often of use here, acting in a non-specific way.

The blood serum from convalescent patients has been tried in this disease, but not extensively enough to prove its value yet.

Symptomatic Treatment.—In the average case of scarlet fever little medicinal treatment is required. The patient will, however, be made more comfortable by the use of a simple fever mixture, such as the one mentioned on page 45. If the temperature reach 103° Fahr., warm sponging is useful, and if this be not sufficient then cooler water may be required. An ice-cap is often of value here, especially if the fever be accompanied by cerebral excitement or delirium. The bowels should be kept gently open by some mild laxative such as cascara or senna.

The skin may be made comfortable and desquamation has-

tened by the daily inunction of sweet oil or vaseline, either plain or medicated with eucalyptol (1-5).

If the throat be very sore, as is often the case, some mild alkaline spray or gargle such as Seiler's solution is useful, or the throat may be cautiously sprayed with 1-100 carbolic solution. If the patient will permit it is often useful to paint the throat with 1-1000 solution of perchloride of mercury made with half its bulk of glycerine, or we may use the *Glycerinum Acidi Carbolici* here, either pure or diluted with an equal part of rose water. Externally, warm compresses give much relief. If pus form in or about the tonsils it should be let out at once. Occasionally abscesses will form in the cervical glands and will require incision through the skin as soon as the presence of matter is evident.

A trace of albumen and an occasional cast are very common in this disease, and do not point to more than a passing irritation of the renal epithelium, but only too often the irritation goes on to inflammation and symptoms of nephritis (or nephrosis) appear. It is commonly believed that any chilling of the surface of the body is apt to bring on this complication and hence the need of care in this direction. Even when nephritis is evident most of the cases do well and the condition quickly clears up, but in a few instances it proves quickly fatal from uraemia or may drift on to chronic nephritis. (For treatment see Nephritis.)

Arthritis may occur, either as a severe septic condition with rapid formation of pus and destruction of the joint tissues, or else, much more commonly, as an arthritis resembling that occurring in acute rheumatism and in the same way being apt to be accompanied by cardiac involvement and perhaps chorea. The affected joints should be wrapped in cotton-wool, and if very painful may be splinted. Salicylates should be given and will afford some relief, although not to the same extent as in true rheumatism. If the heart be involved it requires prolonged rest, etc., as is discussed under that heading.

The ears are very apt to be infected from the spread of the infection from the throat through the Eustachian tubes. They should be inspected every day and any tension of the

drums promptly relieved by incision. In this way permanent damage to the ear structures with resulting deafness may often be averted.

As already said, after the temperature has been normal for a week and in the absence of any complications, the patient may be allowed out of bed, but even then he must for some time be guarded against any chills on account of the danger of a late nephritis.

The desquamation may now be hastened by warm baths, and it is a good plan to rub the surface of the body while he is in the bath with oatmeal. The soles and the palms will require special care here.

During convalescence a bitter tonic is often of value, and if there be any anaemia iron should be given.

MEASLES.

Measles is a common infection in childhood and occurs not uncommonly in adult life as well. One attack gives immunity for some time, but second attacks are not uncommon, and third ones even occasionally occur. In wartime measles is a common source of disability, as it so quickly spreads in crowded communities.

The chief complications of measles are respiratory, and these are responsible for nearly all of the mortality. When measles rages in communities which have not been before invaded, the mortality is very high. It has on several occasions decimated certain tribes of Indians.

Diagnosis.—There is no commoner error in practice than for a physician to mistake a case of measles for one of simple catarrh. The catarrhal stage of the disease is so like a common coryza that the mistake is very excusable, and yet it is a serious one, as it is at this early stage that the disease is most infectious, and hence is so apt to spread before a diagnosis is made. During an epidemic every person presenting any catarrhal symptoms should be isolated until the condition proves not to be measles. It is not our province here to discuss details of diagnosis, but one may mention the importance of the catarrhal state of the eyes, the height of the tem-

perature and the occurrence of Koplik's spots on the buccal mucous membrane, all of which may raise the practitioner's suspicions before the eruption appears on the third or fourth day.

Environment.—The patient must be isolated and kept so for 14 days. The most contagious period is the early catarrhal one before the eruption appears and for five days after this. The room should be warm, 60° to 65° Fahr., but the air must be as pure as possible. Bright sunlight is a valuable sterilizer of the infection in the air, but the patient may require to have his eyes shaded. This is better than the common practice of keeping the whole room dark.

The patient must be kept in bed until the temperature is normal and for a couple of days after this point has been reached, especially if there is any danger of chills from draughts.

Diet.—A fluid diet is advisable as long as there is any fever. The great thirst which is apt to be present may be quenched with lemonade or the Imperial drink. After the fever has disappeared the diet should be plentiful and very nourishing, as the convalescence is apt to be long and our aim should be to raise the general resisting powers of the patient as much as possible, as secondary infections, especially tuberculosis, are otherwise so apt to occur.

Specific Treatment—None.

Symptomatic Treatment.—A simple fever mixture is useful, such as that mentioned on page 45. If the temperature run very high warm sponging may be of service: cold applications are not advisable, especially before the eruption is well out, and this is the time that the temperature is most apt to be high. An occasional dose of some antipyretic, such as antipyrine or quinine is here often of use. If the eruption be delayed or does not come out well a hot bath will often assist.

The toilet of the eyes, nose and mouth is very important. The conjunctival sacs should be flushed out several times daily with warm boracic solution. The nares may be cleared of mucus with soda solution and the tongue and mouth swabbed with Condy's fluid and then smeared with glycerine of borax.

There is always some cough in measles and often it is very

troublesome. In this case inhalations from the surface of hot water of Tincture of Tolu or the Friar's Balsam itself are of service, and it is usually well to give small doses of ipecacuanha and paregoric. These may be added to the fever mixture in five minim doses, making the following:—

℞ Vini Ipecacuanhae

Tincturae Camphorae Compositae āā ʒ ij.

Syrupi Tolutani

Spiritus Etheris Nitrosi āā ʒ iij.

Liquoris Ammonii Acetatis ad ʒ iij.

M.

Sig. A teaspoonful in water every four hours.

This is for a child of eight. Often the respiratory catarrh, which is part of the disease, spreads into the smaller bronchial tubes and thus the dangerous capillary bronchitis occurs, or it may reach still further and signs of broncho-pneumonia appear. The causes of these respiratory complications are secondary infections, and these are very much the same as occur in influenza; and in the sputum *pneumococci*, influenza *bacilli*, or *streptococci haemolytici* are apt to be found. The measles infection predisposes to these secondary invasions just as the unknown cause of influenza does.

Any tendency to diarrhoea should be carefully checked or a severe enteritis may ensue.

Itchiness of the skin can usually be eased by sponging with a watery solution of bicarbonate of soda, one drachm to the half pint. The eyes are very apt to be sore and colored spectacles are here valuable, and the use of them is much better than the common custom of darkening the room. If the eyelids tend to stick together after sleeping they may be gently smeared with soft paraffin. Any infection of the ears must be watched for and appropriately treated. During convalescence an iron tonic, such as the syrup of the iodide of iron, is useful, and cod liver oil is often indicated if the cough be persistent, especially during cold weather.

MUMPS.

Mumps is usually a disease of childhood, but may occur in adult life and then may cause much distress. A second attack is not uncommon during a lifetime.

The chief complication is orchitis, but in the female the mammary gland or the ovary may be the seat of metastatic inflammation. Meningitis, arthritis, nephritis, neuritis, endocarditis, pleurisy or pneumonia, all occasionally occur as complications.

Diagnosis.—This is usually easy. The position of the swelling in the parotid glands and the pain on opening the mouth are characteristic, but occasionally the trouble may commence in the sublingual or submaxillary glands, and then if the case be a sporadic one, it is apt to be missed. Parotitis may occur as a complication of various infections, such as typhoid or influenza, but the other symptoms present will usually prevent a mistake in diagnosis. The parotid scarcely ever suppurates in mumps.

Environment.—The patient should be quarantined for 21 days during which time the disease is contagious. He should be in bed while there is any fever.

Diet.—During the acute stage the patient will have difficulty in eating and fluids will be all that he can comfortably take.

Specific Treatment.—None. We do not yet know the nature of the infection.

Symptomatic Treatment.—No medicine is required unless the fever be high, when a simple fever mixture may be given with advantage (page 45), or the patient may be sponged. The swollen glands should be protected with cotton-wool. If there be much pain hot fomentations are useful. Some use ice here, but as a rule cold gives less relief than heat. Or we may smear the swelling with a mixture of equal parts of ichthyol, extract of belladonna and glycerine. If the tension in the glands be very great the application of a few leeches will often give relief, but it is well to remember that their bites leave permanent marks.

When orchitis appears the swollen glands should be well supported with a roll of cotton-wool and may be smeared with the above mixture.

GERMAN MEASLES (RUBELLA).

This is a highly contagious disease, which rarely causes much trouble, except in the diagnosis, it being mistaken for other and more serious infections, especially true measles and more rarely scarlet fever.

Diagnosis.—The eruption comes out on the first day of the infection and is maculo-papular and very bright in color. There is rarely much fever, but very commonly some swelling of the post-cervical glands.

The patient should be kept in bed while there is any fever. He must be isolated and the quarantine period is two weeks. There is no specific treatment. There are usually few symptoms requiring treatment. The bowels should be kept gently open and the diet light while there is any fever. If the throat be irritated, which is sometimes the case, an alkaline spray or gargle may be used.

CHICKEN-POX (VARICELLA).

This is a mild disease and is chiefly of importance as it may be confused with small-pox.

Diagnosis.—The incubation period is between two and three weeks, and when the disease sets in the eruption appears within the first twenty-four hours and then in successive crops for several days. It shows chiefly on the back, chest and face, and is most profuse on covered parts. It quickly goes on to the vesicular stage and the vesicles may become pustular.

Environment.—The patient should be in bed while there is any fever. It is doubtful whether quarantine is necessary except in public institutions. Then it should be for three weeks, or at least until all lesions are healed.

Diet.—Light fluid diet is advisable while there is any fever.

Specific Treatment.—None.

Symptomatic Treatment.—Few symptoms require treatment here. It is well to paint the spots as they appear with flexible collodion, especially on the face. This keeps them

protected from secondary infections and thus lessens the chances of pus formation with probable eventual pock markings. Any broken pustules should be dusted with boracic powder. The patient must be warned against scratching.

Before mixing with others a bath well-stained with permanganate of potash is advisable.

ERYSIPELAS.

This is an acute, communicable disease, due to infection with a haemolytic streptococcus called the *streptococcus erysipelatis*. The condition is characterized by a rapidly spreading inflammation of the skin, and more rarely of the mucous membranes, with fever and symptoms of general toxæmia.

Diagnosis.—This is usually an easy matter. A spreading inflammation, with raised edges, along with the general symptoms, is characteristic. The inflammation may occur in the vicinity of any wound, but in the absence of such evident local lesion usually appears about the face.

Environment.—In pre-antiseptic days erysipelas was a scourge in hospitals, but now only occurs in sporadic form. The infection is not air-borne nor is it very contagious unless to an open wound. Hence, strict isolation is unnecessary. In many places the disease is a notifiable one.

The patient should, of course, be kept in bed, and be carefully nursed, with special care in regard to the disposal of all secretions and discharges, and the disinfection of linen, dishes, etc.

Diet.—This should be light but as nourishing as possible. In severe cases toxic alcohol is often of value.

Specific Treatment.—Sera and vaccines have both been much used and have their advocates and their opponents. As a rule, the disease runs a short, sharp course and terminates by crisis, and it is always very difficult to say whether such termination is due to any special treatment or merely to an autogenous immunity. If the serum be used it should be in large doses,—say, 30 to 50 c.c. of a polyvalent one intramuscularly every 12 hours. Diphtheria antitoxin has been so used with apparently good results.

In cases that hang fire and continue to wander over the body for long, vaccines may be of some service. An autogenous one is the best, but a stock vaccine is often used. The ordinary dose is 10 to 50 millions every two or three days.

Symptomatic Treatment.—The most generally used internal treatment is the perchloride of iron, in doses of the tincture or of the liquor of 10-20 mins. every three or four hours. This often seems to be of benefit, but should be discontinued, or the dose lessened, if the digestion suffer. The high fever is best controlled by cool sponging. An ice-bag to the head is often very acceptable when the disease is located there. Digitalis, caffeine, and strychnine are occasionally necessary when there is much circulatory weakness. Insomnia is often a troublesome symptom and is well controlled with paraldehyde, or one may use veronal or chloral hydrate. An occasional dose of Dover's powder is often useful.

The remedies that have been used locally are a legion, which bespeaks the limitations of their value. I have found the constant application of compresses of saturated solution of sulphate of magnesia (to which 10 per cent. of glycerine has been added to prevent drying) as good as any. This certainly lessens the pain and discomfort. Occasionally local abscesses form and may have to be opened.

A very slight degree of immunity is established by an attack, as shown by the frequency of relapses or subsequent attacks.

CHAPTER V.

SPECIFIC INFECTIOUS DISEASES, ETC.

MENINGITIS. MENINGISMUS. HYDROPHOBIA. INFLUENZA.
RHEUMATIC FEVER. ARTHRITIS. MYALGIA AND LUMBAGO.

MENINGITIS.

Inflammation of the meninges of the brain and spinal cord may be due to various infections. The condition is always serious and in most infections fatal, but in one type, the cerebro-spinal form, the patient stands a fair chance of recovery. Along with this form we will discuss the treatment of all kinds, which is much the same, except as regards specific therapy. Slight degrees of meningitis occur more commonly than was at one time believed. The more spinal puncture is done the oftener a cerebro-spinal fluid with a high cell count is found, and yet the patients may not be very ill (are often, indeed, ambulatory) and make a good recovery. The culture may show no organisms. A number of such cases occurred in the army, and were discovered almost by accident.

Cerebro-spinal Meningitis.—Sporadic instances of this disease occur everywhere, but occasionally the infection becomes epidemic. The condition is due, or at least is associated with, the presence of the *diplococcus intracellularis* in the meninges. The mortality varies in different epidemics from 20 to 75 per cent. It is especially fatal in infants, most of whom succumb.

Diagnosis.—The recognition of meningitis is usually easy, although the exact bacteriological nature of it can only be detected by an examination of the cerebro-spinal fluid. All the same, in doubtful cases of general infection, where meningitis is only suspected there is some experimental and clinical evidence that a puncture may precipitate a meningitis which was not previously there. Wegeforth and Latham found that if animals were given an intravenous dose of some organism the

pathogenicity of which for the meninges was high and then a lumbar puncture was done they developed meningitis, while control animals similarly infected did not do so. Similarly they found that clinically it sometimes seems to develop after the puncture. The danger is lessened by using a small calibre needle and only drawing off sufficient fluid for examination purposes at first.¹

Environment.—The patient should be isolated. This is partly because he is thus kept quieter, but also because the disease is infectious. The way in which the infection spreads is not yet very clear. It is certainly not infectious in the same sense as is scarlet fever. Thus, for example, among the cases that occurred in the First Canadian Contingent up to the end of November, 1914, no two happened to come from the same unit. Occasionally, several examples occur in the same house, but it may well be said that the condition is no more contagious than is lobar pneumonia which equally at times occurs in groups. It is believed now that the infection is widespread and only exceptionally goes on to meningitis. Thus P. Fildes and S. L. Baker² found at one camp 485 "carriers" of which not a single one developed meningitis. In a certain number of infected people the invasion is a slight one. It may take the form of a respiratory catarrh, of slight fever or of an arthritis, while a few only will have infection of the meninges. I recall one case that was admitted as "acute rheumatism," with involvement of several large joints who several days later developed meningitis from which he died.

In the present state of our knowledge it is wise to quarantine the patient and his attendants as long as there are any *meningococci* in the upper air passages. The naso-pharynx of these people should be frequently sprayed with some antiseptic.

Diet.—There is nothing special to be noted about the diet of these patients except that it should be light and chiefly fluid.

Specific Therapy.—Vaccines have been tried in cerebro-spinal meningitis with the idea of stimulating the body tissues

¹*Amer. Jour. of Med. Sciences*, 1919.

²*Lancet*, 1917, II., 602.

to produce antibodies, but the results have not been good; in fact, in my experience, have been very bad.

It would seem that the body is already almost overwhelmed with toxins, and to add to these is merely to increase the poisoning. But by the use of serum, with the object of bringing about passive immunity, much has been attained. Before the War it seemed an admitted fact that Flexner's serum had done almost as much for this disease as had antitoxin for diphtheria, but military experience was not nearly as good as this. It may have been that the sera of all manufacturers was not of equal potency, or that the strains of the *meningococci* were different, but on the whole the results were disappointing. Nevertheless, they were better than without it, especially if the serum be used with a very free hand. Sir Humphrey Rolleston reports that in the British Navy 502 cases were treated without serum with a mortality of 51 per cent., while 214 received serum with a mortality of 30 per cent. Cerebro-spinal fever is a peculiarly fatal disease in children, and yet H. M. M. Mackay publishes¹ eight cases of it in children under 8 years of age who were treated with repeated lumbar puncture and intrathecal injections of polyvalent antimeningococcic serum, and they all recovered. It is known now that there are four distinct strains of the *coccus* that produce the disease, and if the appropriate serum be used the percentage of cures is greater.

The ordinary method of administration is to do a spinal puncture and allow the cerebro-spinal fluid to run out until it nearly stops, and then partially replace it with 20-30 mls of warmed serum. This little operation should be repeated daily or even every 12 hours in bad cases, and then less frequently as the symptoms subside and the cerebro-spinal fluid becomes clear. It is well to use a general anaesthetic if the patient is nervous, but usually a local one is sufficient. In addition to the spinal administration many advocate the giving of serum intramuscularly or even intravenously. Probably the best and least risky method of reaching the circulation is to give perhaps 40 mls

¹*Lanc.* Jan. 31st, 1920.

of the serum intramuscularly, although in very severe cases the intravenous route may also be employed. As much as 150 mils at a time may thus be given, after a preliminary desensitizing by giving 0.3 to 1 c.c. hypodermically. The object is to saturate the patient with the serum.

Preliminary washing out of the meninges with normal saline solution is sometimes done, but does not seem to have much to recommend it.

When hexamethylenamine (urotropine) is given by the mouth it appears in the cerebro-spinal fluid, and it has occasionally been administered in doses of as much as 60 grains daily here. Sodii aminophenylarsonas (soamin, atoxyl) and salvarsan have also been tried intravenously, but none of these appear to have any specific effect here.

Symptomatic Treatment.—Much relief may be given in all forms of meningitis by simple Lumbar Puncture. The operation is an easy one to perform. The patient should be laid on his side with the back bent by approximating the knees and the chin. After preliminary cleansing of the skin over the lower lumbar region with tincture of iodine or other antiseptic, the needle should be introduced between the 4th and 5th lumbar vertebrae, using either a local or in nervous patients a general anaesthetic. The point of introduction should be in the middle line on a level with the highest part of the iliac crests. The needle should be pushed inwards and slightly upwards. If it strike bone too soon it must be partially withdrawn and tried in a slightly different direction. As soon as it has entered the spinal canal, which can be told by the sense of touch, the stilette is withdrawn and the fluid runs out. It is often useful to measure the pressure of this, which can be easily done by attaching a piece of glass tubing to the needle by means of a small piece of rubber tubing. Note the height to which the fluid rises in the glass tube and mark the level and afterwards measure the height above the level of the needle. Normally, it should not rise above 200 millimetres. About 20-30 c.c. of the fluid may be allowed to run off and then the needle is withdrawn and the wound sealed with collodion. The symptomatic relief is often marvellous and the headache may for the time-being disappear. The relief is evidently due simply to the

lessening of pressure, for it is often noted that if the fluid removed be fully replaced by serum the same relief is not experienced. In most forms of meningitis this symptomatic relief is all that can be hoped for, but in the cerebro-spinal form the operation may be curative. Sir Humphrey Rolleston in a recent report on 163 cases that occurred in the Navy states that in 13 cases lumbar puncture was alone employed, with a death rate of four, which was as good a result as from any of the other treatments used. The dangers of the method are slight, although instances of sudden death have followed its use in basal neoplasms.

In addition to spinal puncture various other remedies may be used to lessen the sufferings. Blistering of the back of the neck was formerly much done, and certainly tended to relieve the pain, but is now seldom employed. Leeches applied here may give much relief. An ice-cap to the head is of value. Occasionally heat gives more relief. The bowels should be kept freely open: any straining at stool gives much pain in the head here. Sedatives, such as bromides, are sometimes helpful. If the suffering be great one must have recourse to morphia.

It goes without saying that when meningitis follows any ear trouble or other source of sepsis surgical treatment will be required. Such cases of meningitis as recover are often maimed, being deaf or less commonly blind, and may also for years suffer much from headache. Many soldiers who had had the disease complained even long afterwards of pain in the lumbar region and this was probably due to the repeated lumbar punctures. In children hydrocephalus may result or there may be delayed mental development.

Meningismus is a condition in which, during some acute infection, symptoms of meningitis occur and yet the cerebro-spinal fluid shows no change. Here there is probably a toxic irritation of the meninges, not sufficient to produce inflammation. Spinal puncture usually quickly gives relief.

HYDROPHOBIA (RABIES).

Only a few words will be said about this comparatively rare but terrible disease. For years it was completely stamped out

of the British Isles due to a strict system of quarantine of all dogs admitted to the country, but during the war it again appeared owing to some dogs having been smuggled in from abroad. On this continent it is always present and in India cases of the disease are quite common, usually due to the bites of jackals.

When a person is bitten by a dog suspected of being mad, the dog should not be killed (unless the body can be at once sent to a laboratory for special examination), but should be closely confined for ten days. At the laboratory it may be possible to find the "Negri bodies" in the brain, which are characteristic of the disease, or if the dog lives for ten days then it can be assumed that it was not mad, as the disease is always fatal within that time once it has developed. It is most important that we make sure if the dog were mad or not, because if so then the bitten person should undergo the Pasteur treatment, while, on the other hand, if it is certain that the dog was not mad, then the patient can be assured of this and thus be saved much mental suffering. If the question be left in doubt, as when the dog has been at once destroyed, then the bitten individual will possibly later develop Pseudohydrophobia, which closely resembles the real disease, but is not fatal. He is suffering from a form of hysteria.. The incubation period for rabies is from three weeks to a year. Bites about the face and neck are particularly prone to cause the disease. Immediate cauterization of the wound may prevent the occurrence of infection and should always be done.

Pasteur Treatment.—The vaccine for this is prepared by passing the virus from the spinal cord of a hydrophobic dog through rabbits until it reaches its most virulent form (*virus fixe*). The spinal cords of rabbits which have been inoculated with this *virus fixe* 7 days previously are then dried. If dried for 14 days all virulence is destroyed; if for 13 days then a little virulence remains; if for 12 then a little more, and so on. The patient on the first day is given a hypodermic dose of a cord dried for 14 days; next one of 13 days, then 12 days, then 11 days, until he reaches one dried only for 3 days. He is now practically immune to the disease with which he may have been infected by the bite of the mad dog. Another

method now much used is the "dilution method," where a one-per-cent. solution of virus from a fresh cord is made. The first injection is 1 in 10,000, gradually increasing from day to day to a less diluted virus. This is an easier and less expensive method than the dried cord one and is now used in many institutes.

From all over the World reports have come of the protective effect of this treatment. Several years ago the total cases recorded as having received inoculation were 54,620, with a mortality of only 0.47 per cent. The mortality amongst those bitten by supposedly mad dogs was believed to be about 20 per cent. formerly. At the Kasauli Institute in India the percentage of failures was 0.68 from 1912 to 1916, and at the Pasteur Institute in Paris from 1886 to 1918 it was only 0.39. The New York Health Department had a mortality of 3.1 per cent. amongst cases which had received the Pasteur treatment between the years 1906 to 1911, but in every instance the dogs had been proved to be mad. Högyes gives a one per cent. mortality amongst 50,000 persons treated, while with this treatment the mortality is about 16 per cent.

When hydrophobia develops in a man, it is practically always fatal and nothing can be done except to make his suffering less. Morphia should here be used freely and chloroform is of use during the paroxysms.

INFLUENZA.

This disease and its complications caused more deaths in two years than occurred as the result of the recent War. The infection appeared in Europe, and soon after in America, in the summer of 1918, and spread rapidly over the whole world.

At first, in 1918, influenza was a mild disease, seldom laying the patient up for more than a few days, and there was almost no mortality. But when it reappeared in the autumn it soon became evident that we had to deal with a serious malady. Some of the mild cases still occurred, but in many instances the fever did not recede or soon became accentuated, and complications, chiefly in the respiratory tract, caused a high mortality. In the Royal Navy in the summer wave there was a percentage of

complications of 0.4, with a mortality of 0.03, while in the autumn there were 6.8 of complications and a mortality of 2.8 per cent.¹

Another wave of almost equal virulence came in January, 1919, and a slighter one in the next winter. The total mortality was terrible. In India alone it was estimated that some seven million deaths occurred. In New York 15,000 deaths took place in November, 1918, which represented a mortality of 60 per 1,000, and this was low as compared to Philadelphia, where it was 158 in the 1,000. Everywhere it was found that the chief victims were young children and previously healthy young adults. This was quite different from former epidemics, such as that of 1889 and the following years, when it was the aged and the delicate who chiefly suffered. The *Lancet* had an annotation upon this peculiar fact, entitled "The Disadvantages of Good Health." The theory then advanced was that many delicate people have already had ill-defined attacks of infection, and hence have acquired a certain degree of immunity, while the previously healthy are, so to speak, virgin soil. The essential nature of the infection is still unknown, although it looks as if a filter-passing organism termed the *bacterium pneumosintes*, recently isolated by Olitsky & Gates of the Rockefeller Institute, were the offending invader, but even if this be so, the chief causes of the mortality are complicating infections with well-known bacteria, especially the so-called influenza bacillus, different strains of the *pneumococcus* and the *streptococcus haemolyticus*.

Diagnosis.—The clinical diagnosis of influenza is usually easy, especially during the epidemic, and all cases, even suspected ones, should be treated with equal care in the hope of lessening the chances of complicating infections.

Environment.—The patient should be in bed and be kept there until the temperature has been normal for at least two days. In some districts influenza is a notifiable disease. The stricter the isolation the less chance there is of spreading the infection. The attendants should wear masks and should frequently use some antiseptic gargle and nasal

¹R. Hill, *Jour. Sanit. Institute*, 40, 1919.

douche, such as 1-5000 permanganate of potash. The sputum of the patient should be received upon cloths which are then burned.

The question of Prophylaxis among the unaffected is a very important and yet unsettled one. Isolation of actual cases is one thing, but the infection is so widespread that nearly everyone must be sooner or later exposed to it during an epidemic. Can anything be done to raise their resisting power? There is no doubt that many people have for the time-being a complete immunity to the infection, in that they have been repeatedly exposed to it and yet escape. As already said, a difficulty here is that the apparently healthy are so often the chief victims.

The use of vaccines has, of course, been widely discussed, but there is no unanimity in regard to their value. The difficulty is that we do not yet know the cause of the disease, although we do know the infections that produce most of the complications.

The British War Office recommended a vaccine of the following nature:

	1st dose.	2nd dose.
Bacillus influenzae.....	30 millions	50 millions
Pneumococcus	100 “	200 “
Streptococcus	40 “	80 “

The two doses to be given with an interval of ten days.

One might quote endless figures, some showing good results from such vaccination and others failing to do so. The health authorities of Ontario could come to no conclusion as to its value, and the New York ones were equally non-committal. Unless series of cases are compared which have occurred in the same epidemic and at the same stage of this epidemic the comparisons are useless, as the death rate varies so much at different times. The tendency is for this to be greatest early in a wave and then to gradually decrease. Vaccination is not likely to have been commenced at the very beginning, and thus, when it has been introduced and the mortality lessens, then it may be falsely argued that the vaccine brought about this result.

Diet.—During the stage of fever a light nourishing fluid diet is indicated. After the fever has gone the patient should be fed up in every way.

Specific Therapy.—Abortive treatment. Many drugs have been advocated as having some effect in cutting short this disease, but none of them have gained universal acceptance, and it seems doubtful if they do more than ease the symptoms. Quinine, especially in the form of the ammoniated tincture, has been widely used, and many believe in its efficacy. It is generally given in drachm doses every four hours.

The Salicylic preparations have been much employed. They certainly make the patient more comfortable, but have no specific effect. It may be noted that E. B. Turner, of London, has strongly urged the use of very large doses of Salicin. He treated over 2,000 cases with 20 grains every hour for 12 hours and then every 2 hours, and in all got the same result, viz., recovery in one and a half days. Aspirin has been similarly used in half these doses. But, as said, epidemics vary so much at different times and at different stages of the same wave that it is hard to get any statistical results. In June, 1918, we had thousands of cases of influenza in the military hospitals with almost no mortality, and yet in October, and again in January, we lost many, although all along much the same treatment had been employed. In several hospitals we placed large series of cases upon salicin and others upon quinine, and yet others upon cinnamon (which happened to be extolled at the time). No definite results were obtained.

In subacute and chronic cases vaccines are often given, in much smaller doses than when used prophylactically. Many believe that in this way the complications are lessened.

Symptomatic Treatment.—The patient should be given the general care of all fevered people. He is in bed and kept warm, but with lots of fresh air, and on a light fluid diet. Beyond this nothing is usually necessary, but he may be more comfortable by the use of a fever mixture, such as that mentioned on page 45, unless, indeed, he is already on salicin or aspirin or some other antipyretic. If the cough be distressing it is well to add to such a mixture some of the Tincture Cam-

phorae Co. Half a drachm of this, representing $\frac{1}{8}$ grain of opium, will lessen the cough and does not usually constipate.

Such a powder as the following is useful and gives much comfort:—

℞ Acid. Acetyl-salicylat. gr. v.
 Phenacetin.
 Pulv. Ipecac. Co. āā gr. ss.
 Fiat pulv.

Sig. 1 every 4 hours.

In an irritable cough inhalations may be tried, such as the Tincture of Tolu, one teaspoonful inhaled from the surface of hot water, or a Eucalyptus vapor inhaled from a handkerchief, such as that recommended for bronchitis.

In cases of oppression in the chest a mustard leaf or poultice over the manubrium sterni will often give relief. Neither should be left on for more than 20 minutes.

If he be restless and sleepless bromides are useful, or even chloral hydrate. A good plan is to give 20 grains of the former about 6 p.m., and 10 to 15 of the latter at 9 o'clock.

When complications occur they must be handled according to the indications. They are nearly always of the respiratory type.

After the acute stage of influenza is over there often remains an exceptional degree of weakness, apparently out of all proportion to the amount of fever that was present; and the patient very slowly gets back to his normal state of health. Tonics, especially those containing strychnine, are now useful and also much feeding up. Great care should be taken that the patient does not return to work too soon, and also that he avoid chills, as relapses are common from these and are very apt to be associated with complications.

RHEUMATIC FEVER.

This disease is apparently due to a *streptococcus*. It is not contagious. One attack does not confer immunity; in fact, it appears to predispose to further invasions.

The disease is characterized by a sweating type of fever,

with inflammation of the large joints and frequent involvement of the heart.

Diagnosis.—Pains in the joints, of a shifting nature, fever and sweating usually make the diagnosis of acute rheumatism an easy one. The way in which the infection moves from joint to joint is very characteristic, and the physician should always be on the alert to change his diagnosis when the inflammation persists in any one joint. In children there may be little pain and distress; often only “growing pains” are complained of, and yet the worst complication of the disease—acute involvement of the heart—may occur. As a rule, the younger the patient the less the distress, but the greater the chance of heart involvement. Hence the necessity of treating every suspected case with the greatest care. A sore throat in a child, accompanied by any pains in the joints, should be considered to be of this nature and treated accordingly.

Environment.—The patient should be in bed, in a warm, well-ventilated room, and it is customary to put him between blankets. When he has sweated much, as he is apt to do even apart from treatment, the clothing should be changed, as he is very apt otherwise to get a chill.

It is well to keep the patient in bed for at least a week after the fever has gone and specific treatment has been discontinued, and even then he must be closely watched, as relapses are common and are undoubtedly precipitated by cold. If the heart has been involved he may require to be kept in bed for many weeks or even months.

Diet.—During the acute stage the diet should be light and of the lacto-vegetarian type. He should be encouraged to drink watery drinks freely. A home-made lemonade, to which bicarbonate of potash has been added in the proportion of 20 grains to the pint, is very grateful to the patient, and probably has some therapeutic value.

Specific Treatment.—In every case of acute rheumatism the throat should be carefully examined, as often the focus of infection lies in the tonsils. If these are found to be in a pathological state (and much difference of opinion exists as to just what this means) they should be removed, although most sur-

geons prefer, if possible, to wait until the fever has gone before doing this.

Two classes of drugs seem to have some specific action in this disease. They are the alkalies and the salicylates. Formerly, physicians employed alkalies in huge doses here, but since the introduction of the salicylates this is seldom done, although they are usually combined with these.

In whatever form the Salicylates are given, they occur in the blood as the sodium salt and eventually appear in the urine, largely as the salicylic and salicyluric acids. As such they may irritate the kidneys and produce a temporary albuminuria. This fact should be remembered in the treatment of patients already nephritic. All the salicylates tend to irritate the stomach, the most irritating form being the salicylic acid and the least the salicin.

The usual method of administration is to give the sodium salt in doses of 20 grains every two, three or four hours, combined with an equal, or even a double, amount of the bicarbonate of soda or other alkali such as acetate of potash. As the pains and the fever lessen these large doses may be diminished or given less frequently. The drug should be continued in ever-decreasing doses for at least a week after the temperature has become normal. If it be stopped too soon the fever tends to recur. Often in the late stage, especially if the stomach has begun to resent the salicylate of soda, the salicin does well, given in doses of 10 grains every four hours and then thrice daily. The acid itself is little used internally. Acetylsalicylic acid (aspirin) may be employed instead of the sodium salt in half the amounts. It seems to be more powerful in relieving the pain, but is probably more depressing. The mawkish taste of salicylate of soda is well covered by liquorice. The drug may be conveniently given in milk. Aspirin and salicin are almost insoluble in water and can be taken in capsule or powder form.

In many people the salicylates cause disturbance of the stomach, singing in the ears and even deafness. The eyesight is occasionally interfered with and visions may occur, these usually taking a yellow colour. One patient, a woman, while taking full doses, saw visions of yellow corpses about the ward. The drug was stopped and the visions soon changed to the

more pleasant form of yellow flowers and then disappeared. As already mentioned, renal irritation may occur, and the urine should be constantly watched for any sign of this.

These toxic symptoms are less apt to appear when the salicylates are given in combination with alkalies.

If patients cannot stand the salicylates, which is rare, then the alkalies may be given alone. It is usual here to use the potassium bicarbonate in doses of 30 grains every four hours.

Salicylates and the alkalies without doubt relieve the pain and lessen the fever, but it is doubtful if they decrease the tendency to heart complications, and hence the extra need of watching the patient carefully in this respect and of keeping him in bed for at least a week after the fever has left him and the treatment has been stopped.

Symptomatic Treatment.—The bowels should be kept gently open, best by salines after an initial mercurial such as a couple of grains of calomel. Sometimes the pain is so severe that morphia may be required for a few days. The affected joints should be wrapped in absorbent cotton, and if there be much pain it is well to apply splints to keep them at rest. Nature tends to fix the joints by keeping the surrounding muscles taut, but, as the patient falls asleep, he is apt to move and this causes pain and wakes him up. The splints save him from this. Commonly some lotion is applied to the joints, the one most often used being Fuller's lotion, which consists of potassium bicarbonate $\frac{1}{2}$ oz., tincture of opium 1 oz., glycerine 2 ounces, and rose water to 12 ounces. It is doubtful if any of the opium is absorbed, but if applied freely and hot the application gives some relief. The affected joints nearly always recover completely, but in the rare event of any stiffness or pain remaining, blistering may help or perhaps better still the use of Scott's dressing (*Unguentum Hydrargyri Compositum*). Gentle massage will also be of assistance here.

Occasionally, the temperature runs very high, with perhaps delirium, and the salicylates may fail to control it. Here, hydropathy is of most service, the patient being wrapped in a sheet wrung out of cold water, and rubbed with ice; or he may be put for 15 or 20 minutes into a bath at 75° Fahr. and

then ice added, a close watch being kept on the temperature and the pulse.

Most cases of acute rheumatism clear up easily and completely under some such treatment as above indicated, but occasionally one sees attacks drift into a subacute type, which will not yield to drugs. In such instances the use of non-specific protein therapy, as described on page 95 is sometimes valuable, and the writer has seen even a single dose of typhoid vaccine completely clear up such a case. Usually, however, several injections will be required.

ACUTE ARTHRITIS.

Acute inflammation of the joints is an occasional complication of various general infections. Often the condition is very transient and then is probably rather of toxic than infective origin.

Only a few general suggestions can here be given for the treatment of such conditions. The affected joint or joints should be kept absolutely at rest, best often by the use of splints. In the case of the knee it is well to keep the limb extended, in the case of the shoulder moderately abducted, and when the elbow is the seat of the trouble then at a right angle. The hip joint can best be steadied by the use of extension weights. Not only are the joints easier in these postures, but in the event of fixation occurring, they will be in the most useful positions.

Any pain may often be relieved by the free use of the salicylates, the best of these being aspirin in doses of 10 to 20 grains as often as every four hours, although the effect is not nearly so great here as in acute rheumatism.

Locally, hot moist dressings, such as the Fuller's lotion, are of value. Ichthyol and belladonna ointments in equal parts make a good application. In the more persistent cases Scott's dressing (*Unguentum Hydrargyri Compositum*) tends to relieve the pain and thickening.

If redness, swelling and much heat are present, the presence of pus should be suspected and an exploratory puncture with a needle may reveal this, and then the exact nature

of the infection can be determined. It has often already been suspected from the original source of the infection. A gonorrhoeal infection does not usually require surgical interference, but if the pus show *streptococci* or *staphylococci* or other pus organisms, then the joint should be surgically treated and probably drained. Where the original source of the infection can be reached it should, of course, be attacked. The teeth, the tonsils, and the urino-genital tract are commonly the site of such foci.

SUBACUTE AND CHRONIC ARTHRITIS.

With the exception of acute cases due to rheumatic fever and gout, most active inflammations of joints tend to drift into the subacute and chronic stages, with the production of much disability and suffering. But many of these cases have no acute onset and are subacute or chronic from the first. They come on insidiously.

The treatment of these patients is on the whole unsatisfactory, as is shown by the multitude of remedies that have been employed. Whenever the student finds that a great variety of treatments are advocated for any one condition he may assume that none of them are very satisfactory. Thus, for example, he sees that antitoxin is universally used in diphtheria, and he may conclude that it is a most efficient weapon, while, on the other hand, the divers suggestions that are made for the treatment of a common cold mean that none of them very certainly attain their end. The therapy of subacute and chronic arthritis belong to this latter class. Still, much may be done for these patients, especially in the way of lessening their suffering and disability, and also to a smaller extent in bringing about complete recovery in some instances.

All forms of treatment cannot be here discussed, but a general outline of the more usual methods employed will be given.

Diagnosis.—Sometimes this may be accurately made, as when we diagnose gonorrhoeal or tuberculous joints or come to the conclusion that the case is one of arthritis deformans, but in many instances (including, indeed, the one last named) the exact underlying cause remains obscure. To many of these cases the name of subacute or chronic rheumatism is given,

but this is only a cloak for our ignorance. These terms are very properly not used in the official nomenclature of the British Army.

The possibility of some local focus of infection elsewhere should always be borne in mind and systematically searched for. The clearing up of such may completely relieve a long-lasting joint affection.

Environment.—These patients are very susceptible to cold and chills and hence should be warmly clad, especially round the joints affected. Many chronic arthritics believe that they can tell an impending change of weather by an increase in the aching of their joints.

Cases of any acuteness are best in bed or at least at rest. If less acute, an even dry climate will best agree with them. These patients are nearly always better in summer than in winter, and hence, where finances permit, a perpetual summer, such as may be got by wintering in the South, is desirable. On general principles, the more they are in the open air the better. Some have believed that direct sunshine has a special virtue here, and the painful joints may be exposed to the sun's rays for several hours a day. The effects of sunshine upon the body are profound. Experimentally, it has been demonstrated to increase the activities of lymphoid tissue, as shown by an increase in the leucocytes, and to raise the resistance of animals to cancer and tubercle.¹ A demonstration before the International Medical Congress in London in 1913 of the good effects of sunlight on even advanced cases of tuberculous infection of joints and other tissues was very convincing.

This subject of Heliotherapy has attracted much attention in recent years. The method has been greatly elaborated by A. Rollier, of Leysin, who has published his results in an Oxford Medical Publication of nearly 300 pages. The practitioner who is interested in the subject will do well to study this very attractive work.

Diet.—A simple nourishing diet is best here. These patients do not require the semi-starvation and cutting out of most of the nitrogenous food which has often been practised upon very theoretical grounds. Much harm may be done by a

¹*Lancet*, Ap. 5, 1919, p. 574.

too lowering diet. It has lately been suggested that a high carbohydrate diet is at least partly responsible for many of these joint affections and the cutting out of this seems to have given a good deal of relief. It will be interesting to watch the further results of this experiment.

Ralph Pemberton¹ believes that the condition "consists in an interference with the respiratory functions of the circulatory blood." There is a low sugar tolerance. Cutting down the intake of this rests metabolism as it does in diabetes.

Specific Treatment.—Tuberculous joints and those infected with pus-forming organisms belong chiefly to the domain of surgery, but the medical aspect is also important. Syphilitic arthritis responds well to specific treatment (q.v.) As already said, any foci of infection must be searched for and appropriately treated.

Vaccines for inflammations of known infection are much used and often give satisfactory results, although it must be admitted that this is not always the case. The one best suited for this form of treatment is gonococcal arthritis. In all cases where it is tried an autogenous vaccine should be used if possible. Lately, non-specific vaccine therapy has been much advocated. Several years ago it was found that a typhoid vaccine gave nearly or quite as good results in gonorrhoeal joints as did a specific one. It was first tried in an infection of the wrist, which was very persistent and crippling, and in 48 hours the joint was well.²

Other vaccines have been used with equally good results and also albumose and peptone. No doubt the good effects of phylacogen, which have so often been reported, are of the same nature. A great deal of literature has recently appeared in regard to this subject of non-specific therapy. Lately A. E. Gow has written fully on the subject³. He uses 0.5 to 3 c.c. of typhoid or colon vaccine (corresponding to 50 to 100 millions of killed bacilli) diluted in 10 c.c. of normal saline, and gives this intravenously. Or 10 per cent. solution of peptone in the same quantity, given very slowly. A definite train of symp-

¹*American Jour. of the Medical Sciences*, April, 1921.

²*Ther. Gazette*, Aug., 1916.

³*Brit. Med. Jour.*, Feb. 29th, 1920.

toms follows, which has been called by American writers "protein shock." The temperature rises and there is a sharp leucocytosis. A rigor is frequent and there may be some nausea and dyspnoea. The distressing symptoms may be quickly relieved as a rule by a hypodermic injection of 1/100 gr. of atropine sulphate or 0.75 c.c. of 1-1000 of adrenalin solution. The way in which a foreign protein acts is obscure, but in some manner it causes a change in the delicate balance of the body fluids. It is known that a negative phase immediately occurs during which there is increased permeability of the capillaries and the washing into the blood of various products of cell metabolism. This is soon followed by a positive one when the permeability is lessened.¹ A reaction occurs in the infected joints, with a temporary increase in the distress and then a tendency towards a return to the normal. Normal joints show no change. The effect would seem to be on a par with the good results that often follow the application of irritants to a chronic ulcer of the leg. The injections may have to be repeated a number of times. A similar reaction follows the intravenous injection of various metal colloids, and it has been shown by A. G. Auld² that this is due to the protein protective substances that are used in the production of the colloids. When the colloids are freed from such substances no reaction follows their injection.

Symptomatic Treatment.—Some subacute and chronic joints require rest for a time and had best be splinted, especially at night, but we must always be on our guard here lest they be kept too long in one position, with resulting adhesions. When any fixation is used the joints should be kept in the positions in which they will be most useful in cases of adhesions occurring. Even normal joints, if kept splinted for long, tend to become stiff and are often hard to restore, as was frequently seen in recent military practice. Hence, as soon as possible in all cases, splints should be removed and gentle massage and passive and then active movements practised. Massage of the surrounding muscles is of great value.

Counter-irritation is often useful, either with iodine pig-

¹A. J. Clark. *Brit. Med. Journal*, Feb. 24th, 1923, p. 313.

²*Brit. Med. Journal*, Nov. 19th, 1921, page 822.

ment or more powerfully by fly blisters. The best preparation of iodine for the purpose is probably equal parts of the strong and weak B. P. tinctures. This should be painted on night and morning until the skin becomes irritable, and then less frequently. A blister is best applied just off the joint. Severe blistering over the spine has been enthusiastically advocated from time to time in bad cases of rheumatoid arthritis. Dobson states¹ that he has never failed to see much benefit from it. Fly blisters, two or three inches square, are applied over the 7th and 8th cervical vertebrae and from the 10th to 12th dorsal, and the blisters afterwards kept open for two or three weeks with Savin ointment. The method is used as a routine one in the London Freemasons' Hospital. I have tried it with some success. Scott's dressing is here also of value.

Hydropathy of various kinds often gives relief, and this form of therapy has been greatly developed at the different spas. The results are often so good that one must admit the value of these resorts, although the forms of treatment often seem unnecessarily detailed and calculated rather to impress the mind of the patient than the local affection. The whole surroundings at a spa are probably of as much value as are many of the special treatments. Wet compresses, constantly applied or only used at night, certainly ease the pain. They should be changed as often as they become dry. The Scotch douche, where alternate jets of hot and cold water are made to play upon the joint, is occasionally of value.

Perhaps the best method of relieving the local pain is the use of the Hot Air Bath. Here the limb is placed in a special apparatus in which the air is heated by lamps or by electric bulbs until it is as hot as it can be borne. The limb should be so treated for about half an hour and then wrapped in flannel. The so-called electric light baths probably only act by the production of heat, and for this purpose are convenient. When the arthritis is general the whole body, omitting the head and neck, may be placed in a special chamber and heated in the same way. Most of these chambers are so constructed that the patient must sit up with the head out, but it is much

¹*West London Medical Journal*, October, 1922.

better that he should receive the treatment in the horizontal posture, as syncope may otherwise occur.

Ionisation has been a good deal tried in chronic joint affections. The negative pole is placed upon some neutral part of the body and the positive in the solution of the drug to be used. Potassium iodide has been much tried here. The results have been on the whole disappointing although some patients are benefited.

Electricity has also been much extolled. Here, as in many of the methods of treatment, probably the psychic element plays an important part, but what of that if the patient gets relief.

As regards general medicinal treatment, potassium iodide is most often of value in doses of five to ten grains. Luff has strongly urged the use of guaiacol carbonate in 10-grain doses thrice daily in cases of arthritis deformans. Arsenic and iron have their place as tonics here. Many of these patients desire some opiate for the relief of their suffering, but the physician should be very backward in yielding to this demand as the condition is likely to be of long duration and the habit is thus apt to be formed.

Thyroid inadequacy is often present in these chronic arthritic patients and they may be benefited by the use of the extract in doses of about 1 grain thrice daily.

Fortunately, in many chronic joint affections, especially in the type called arthritis deformans, a stage is reached when the pain ceases, and then only the deformity remains to cripple the patient.

MYALGIA AND LUMBAGO.

These conditions, especially the former, were the cause of much disability amongst otherwise healthy soldiers. In every army thousands of men passed through the hospitals and were perhaps invalided as of no further military use, or else spent months in the base hospitals and the convalescent camps with a diagnosis of myalgia. It was often difficult for the medical officer to gauge the degree of suffering and incapacity, as most of the symptoms were subjective, but, although myal-

gia was probably the most frequent refuge of the shirker, there was no doubt of the amount of suffering and disability in most cases.

Diagnosis.—It is very important that we be sure by a thorough examination that in dealing with a supposed case of either of these affections we do not miss some serious organic disease such as tuberculosis of the spine or a neuritis.

Lumbago is an inflammation of the *fasciae* about the lumbar region, the exact cause of which is uncertain. The same condition may occur in any part of the body where similar tissues exist. Stiff neck and pleurodynia are of the same nature. In myalgia we probably have an inflammation of the *fasciae* of the muscles due to perhaps the same underlying cause. This cause may be called "rheumatism," but that does not help us, as we do not know what that is.

Environment.—All acute cases should be in bed and kept warm. They usually crave heat. Any chilling of the surface of the body at once tends to increase their symptoms and to aggravate the condition.

Diet.—It has long been the custom to cut out nitrogenous food from the dietary of these patients, but while it may be wise to restrict this to a certain extent, as they are not getting much exercise, it is not necessary to do more than this. Many of them are ill-nourished and they rather need feeding up than semi-starvation. It is well to restrict alcohol and most of them are better without it altogether.

Specific Treatment.—The present belief is that most of these cases are due to some localized focus of infection elsewhere, such as a tonsillitis or sepsis at the root of the teeth, and all such possible sources of infection should be searched for and treated. How often lumbago and myalgia are due to an infection was shown by the fact that so many of them turned out upon careful examination to be examples of trench fever. This being the case, it is equally probable that many others are similarly caused by some undetected infection. The theory that the condition is due to some metabolic toxæmia is now losing ground, although there is no doubt that in some instances, as in chronic gout, this is the case.

Iodide of potassium in moderate doses, given over a long

period, has some eliminative action here, and is often useful. The late Sir Lauder Brunton said that in his many years of out-patient practice at the hospital he only twice got letters of thanks from patients, and on both occasions it was in cases where he had prescribed this drug for chronic lumbago. The guaiacol carbonate in ten-grain doses is often serviceable, and in gouty cases special treatment will help. (See Gout, page 375.)

Symptomatic Treatment.—In lumbago and myalgia the salicylates are usually tried and often give some measure of relief. Alkaline aperient waters and saline laxatives should be employed to a moderate extent where required. Locally the liniments are useful. They should be gently rubbed in with a warm hand and thus ease the pain—largely, it may be, through the massage action. One of the most comforting is the old-fashioned “A. B. C.” liniment, which consists of equal parts of the liniments of aconite, belladonna and chloroform. Or a more stimulating one may be used, such as the following:

R	Ol. Sinapis Vol.	min. xv.
	Menthol	gr. xv.
	Spirit. Rectificati	ad ̄ ij.

Localized heat as described under arthritis is invaluable. The use of a hot iron applied over brown paper is much employed by the laity in lumbago. In this condition, especially in the acute form, Dry Cupping will frequently give surprising relief. Peoples all over the world seem to have discovered the value of dry cupping. Their exact methods differ, but the principle is the same everywhere. The Bedouins of the desert use goats' horns for the purpose. Thick edged tumblers make good cups and can usually be procured anywhere. The skin over the lumbar region is first wetted with hot water. Then the edges of the cup are smeared with a little vaseline. A vacuum is produced in it by burning a wisp of cotton wool, or better still with alcohol. A few drops of alcohol are poured into the cup, and moved about so that all the interior surface is moistened with it and then any excess is thrown away. Now light the alcohol, let it burn for a few seconds and then smartly apply the cup to the surface over the pain-

ful area. At once a dome of skin will rise into the cup. The vacuum effect may be made greater if the cup be rubbed with a piece of ice. Other cups are applied in the same manner, and they are each left on for five minutes. To remove a cup all that is necessary is to press the skin with the finger near part of the margin, and the air at once rushes in and the vacuum is relieved. The reddened cupped surfaces should now be smeared with vaseline. Biers' cups act in the same way and may be conveniently used. Where a more powerful effect is desired wet cupping may be practised. Here the skin is first incised slightly and when the cup is then applied blood is drawn from the incisions. Blistering, the Paquelin cautery and the constant electric current are all occasionally of value. Acupuncture will frequently relieve a severe lumbago. A number of No. 8 needles are inserted vertically through the skin to the depth of $\frac{1}{2}$ to $\frac{3}{4}$ inch, about two inches apart. They are removed a couple of minutes later. Probably the puncturing eases the deep tension. In less acute cases Plasters are of value. They protect from chills and give slight support. Also in some instances the contained drugs may be absorbed. The one in commonest use is the *Emplastrum Belladonnae*, either the B.P. one, or one containing also capsicum.

Often the galvanic current is of value, the positive pole being placed over the site of the pain.

It is well for a patient who has had lumbago to wear a flannel belt for some time afterwards, as relapses are so easily induced by a chill.

CHAPTER VI.

SPECIFIC INFECTIOUS DISEASES.

MALARIA. SYPHILIS.

MALARIA.

Malarial fever is one of the scourges of the world. In some places it has been partially conquered, but it still remains the chief danger in tropical and subtropical countries. For ages it has been treated empirically with cinchona and quinine, but all modern therapy dates from the discovery in 1880 of the *plasmodium* by Laveran as the cause of the disease, and then some years later, in 1895, the equally great discovery by Major (now Sir Ronald) Ross, that it was the anophiles mosquito that was the intermediate host of the parasite.

It thus became clear that if the mosquito could be controlled the occurrences of malaria would cease, and much has been done in certain parts of the world in this direction, and many places that were formerly uninhabitable, notably the Panama Canal area, have been made comparatively safe. It is said that the total death rate in that district is now less than in New York. But it is not an easy matter to suppress the mosquito, and malaria still remains a menace to mankind.

Clinically there are several types of the disease. These are Quotidian, Tertian, Quartan and the Aestivo-autumnal.

The quotidian variety is characterized by daily attacks of the fever, the tertian by attacks every second day, the quartan every third day, while in the aestivo-autumnal or remittent form there is a continued fever, giving a temperature chart not unlike that of typhoid fever.

Besides these types we have the malarial cachexia, where there is slight and indefinite fever, with an enlarged spleen and chronic ill-health.

Diagnosis.—The recognition of malaria is usually easy from clinical signs, and the diagnosis can nearly always be confirmed by the finding of the organism in the blood. The type

of infection can also thus be confirmed as each variety is due to a special form of the plasmodium. Thus, the *plasmodium vivax* is found in the tertian, the *plasmodium malariae* in the quartan, and the *plasmodium falciparum* in the aestivo-autumnal form. It has been noted, however, that the remittent type of fever may be caused by any of the different forms of the parasite. Quotidian malaria is not due to any special form of parasite, but is really caused by two or more crops of the tertian or quartan sporulating, so that an attack occurs every day.

Black water fever occasionally occurs in malaria and is very fatal. The red blood cells are destroyed either by the malarial infection or by some unknown toxin. Some have ascribed it to quinine but I have seen it fatally occur where none of this drug had been taken for months.

Although the mosquito is the almost constant conveyor of the infection it is interesting to note that malaria has been purposely or accidentally transmitted by direct inoculation of the blood of a fevered patient into a healthy recipient, and lately direct inoculation of benign tertian fever has been used in the treatment of general paralysis of the insane. It is interesting to note that it can be done from host to host very many times.¹ Exactly the same thing may occur in trench fever, where the infection is usually conveyed by the body louse, in which it undergoes a stage of its development, and yet the blood of a trench fever case if injected will produce the disease.

Where laboratory facilities are not available it is wise to treat all suspected cases of malaria as malaria, and the good results following the administration of quinine will often confirm the diagnosis, as this drug has a much less decided effect in other fevers.

Environment.—We are not here concerned with prophylaxis, but it is certain that if people can be protected from the anophiles, either by the destruction of these insects (best done by drainage and the treating of stagnant pools with coal oil) or by the avoidance of mosquito-infected areas in making camps, etc., and by the use of netting to prevent the entrance

¹*Brit. Med. Journal*, May 26th, 1923, page 895.

of the pest into houses and tents and by the use of mosquito nets for the face and gloves for the hands, or, lastly, by employing various aromatic applications to the skin to keep the insects off, the disease can be avoided. These precautions, however, can often not be taken, and, except in a few favoured places, we still have malaria occurring wherever the anophiles is present. Moreover, when once an individual has been infected he may have attacks for years afterwards, in spite of all treatment, and long after he has left a malarial district. It is believed in the tropics that going to sea is apt to bring out a dormant malaria, and my own experience is in favour of this view. The cool air seems to precipitate an attack.

It has for long been believed that certain drugs, for example arsenic and especially quinine, have a prophylactic value in regard to malaria, but this view has been largely discounted during the recent war, although there are still many who believe that quinine has here a place, when given in daily doses of five to ten grains. Personally, I believe that it is of some value here and always advise anyone going into a very malarial district to so treat himself. When once a man has had malaria a prolonged course of quinine lessens his chances of relapse without doubt. This has been most decidedly shown by military returns, which have also emphasized the immense value of such measures as an abundant supply of nutritious food, work graduated to the patient's powers, occupation for the mind, a cheerful environment and a congenial climate in preventing relapses.

When a patient gets an attack of malarial fever he should be put to bed. For his own comfort, as well as for the protection of others, he should be protected from mosquitoes. No further isolation is necessary. In the first, or cold, stage, he will want much heat, even on a tropical day, but later on will require few bed clothes and as much cool air as is available. A hot bath at the onset is often comforting.

Diet.—During a paroxysm of fever little food is required, but there is usually great thirst, and this may be slaked with free watery drinks. Between the attacks the nutrition should be high in order to raise the general resistance as much as possible. When a malaria-carrier gets chilled or tired or wor-

ried he is apt to have an attack. There was much evidence produced before the Indian Opium Commission some years ago of the value of opium in warding off such attacks. The Indian native believes this very firmly.

Specific Therapy.—Malaria is one of the few diseases that we can specifically treat with drugs with success. The drug here used is quinine. Quinine is the chief active principle of cinchona bark. The cinchona tree is a native of South America, and its power in relieving people of malaria has been known since before history began. There is a native legend that the South American lion was the first to discover the virtues of the tree, and when he has fever he licks the bark. Another legend says that the first time the value of the tree was discovered was when some travellers left a fever-stricken companion to die beside a pool of water that was too bitter to drink because a cinchona tree had fallen into it. The poor wretch, in his desperate thirst, drank of the bitter water and straightway his fever left him, and he soon joined his comrades at another and sweet pool. The fame of the bark spread and soon an infusion of cinchona became known as a cure for fever and ague.

Quinine is a direct poison for the plasmodium, although it has lately been suggested that most of its effect is produced by its presence in the system stimulating the production of an antibody.

The drug is generally used in the form of its salts, usually the sulphate, the hydrochloride and the acid hydrochloride. The last is freely soluble in water, and is chiefly employed when we wish to give quinine intravenously, or intramuscularly. The pharmacopoeial dose of each of them is 1 to 10 grains, but the latter amount may be much exceeded on occasion.

Quinine is chiefly absorbed in the small intestine. While in the stomach it is somewhat irritating, and hence should be given after meals or at any rate followed by a draught of water. It is extremely bitter and can generally be given best in capsule form. Quinine pills, and even more, tabloids, are apt to become very hard and insoluble, and I have recovered both from the stools unchanged.

In an average case of benign tertian malaria the patient may be given five grains of quinine sulphate thrice daily on the off days and double this amount on the morning of the expected attack. Such treatment will usually stop the attacks very quickly, but the five grains thrice daily should be continued for some days and not stopped until the blood is free of the organisms and even then only gradually lessened.

In chronic cases the method recommended by Sir Ronald Ross is to give ten grains before breakfast regularly, and if an attack occurs then this dose three times daily for two days. Most physicians, however, prefer to give quinine after meals.

In severe cases of malaria, which will not yield to doses by the mouth, and in those instances where the stomach is irritable, the drug may be given intramuscularly. Here, 0.5 gram. of the acid hydrochloride should be dissolved in one mil of sterile distilled water and injected deeply into the muscles over the shoulder or in the gluteal region. This dose may be repeated in twelve hours. The intramuscular method is painful and may produce local necrosis of the tissues. Sir Leonard Rogers is strongly in favour of the use of bihydrochloride of cinchonine in this way. The dose is 7-15 grains daily.

Many prefer the intravenous method of giving quinine in severe cases. If this be employed it is convenient to use the ampules of the acid hydrochloride that are prepared by various drug firms, and one can then be sure of an accurate and aseptic dose. It has often been said that there is danger here of coagulation of the blood and haemolysis, and that hence the drug should be given in extreme dilution, e.g., five grains in two or three pints of normal saline, but Baccelli used the concentrated preparation without trouble, and recently his method has been amply confirmed. 5 to 15 grains of the bihydrochloride in a large syringe full of warm sterile normal saline is employed. If the dilution of 1 in 40 is used then the hydrochloride may be employed, which has the advantage of being a neutral salt. After such an intravenous injection the patient may complain of tinnitus aurium, deafness, transient nausea and a sense of heat spreading over the body. It is important that the injection be done slowly or a serious fall of blood pressure may occur. The good effect of this treatment in even the most

malignant cases of malaria is often marvellous, and from a state of convulsions, algidity and collapse, the patient may in a few hours be out of danger. But the case is not yet cured and will require to take quinine orally for weeks. Occasionally, in mild cases, where the stomach resents quinine, this may be given by the bowel in rather larger doses of the acid hydrochloride or the hydrochloride. It is slowly absorbed from here.

Quinine is never given subcutaneously.

In malarial cachexia, and in some of the other types, one sometimes sees the infection hang on and the case seems to become quinine-resistant. Here Warburg's tincture often acts well. It is a mixture containing a number of aromatics and cholagogues and 8 grains of quinine to the ounce, and in spite of this small quinine content may act when larger doses of the plain drug fail. The aromatics and the cholagogues appear in some obscure way to accentuate the action of the quinine. In these long drawn out cases, too, arsenic may be of value. It may be given by the mouth as Fowler's solution, or more powerfully intravenously as salvarsan.

Quinine is most deadly to the parasite of malignant tertian fever, next to that of benign tertian, and least so to that of quartan fever. Major H. W. Acton¹ found that after a month of quinine treatment only 20 per cent. of benign tertians were "cured," taking as a test of "cure" the absence of symptoms, and of the parasite in the blood, for two months after the treatment was discontinued. He also found that after a similar course of cinchonine 40 per cent. were cured, and after "cinchona febrifuge" over 50 per cent. This last is a preparation containing the total alkaloids of cinchona bark, and is made at the Government factories in India and issued in 3½ gr. tablets, of which two are given t. i. d. It is much cheaper than quinine, and if these results are confirmed should largely displace it in the treatment of benign tertian. Apparently the most active element in this preparation is the quinidine, which is present to the extent of 22.8 per cent. Grain for grain, cinchonidine is more powerful than quinidine, but it is present in the preparation in much smaller proportion.

¹*Lancet*, June 12th, 1920, page 1257.

A later report from India¹ confirms the value of cinchona febrifuge, and equally of a Javan preparation sold under the same name but which contains less quinidine and more cinchonidine.

Before administering quinine it is well to give some purgative, especially one having a cholagogue action, such as mercury. The intravenous use of antimony has been advocated for persistent malaria, but has not yet been fully endorsed.

One occasionally sees patients who have an idiosyncrasy to quinine and in whom medicinal doses may set up untoward symptoms, such as skin rashes, and more rarely amblyopia. In such people the treatment of malaria becomes a difficult problem.

Symptomatic Treatment.—The specific treatment of malaria so predominates that the treatment of mere symptoms is comparatively unimportant.

If the temperature runs high, hydropathy is indicated. An ice bag to the head will frequently give much comfort. In bad cases stimulants may be required to assist the failing circulation.

During convalescence, iron and arsenic are often used, as there is a great tendency to anaemia, and the patient should be fed up as much as possible. A change of air, especially away from the malarial district, is frequently required.

SYPHILIS.

This common disease is due to infection with the *spirochaeta pallida*, or *spironema pallidum*, to use the term adopted by the Medical Research Committee. This organism is now believed to be a bacterium and not a protozoon. Enormous numbers of the parasite are present in congenital, primary and secondary lesions, but they are scanty in tertiary ones. The parasymphilitic lesions have been demonstrated to be the seat of actual infection also, and hence are truly syphilitic.

Monkeys, apes and rabbits can all be infected and are much used for experimental work.

¹*Lancet*, January 20th, 1923.

The primary and secondary lesions are contagious, the tertiary only slightly so, and parasyphilitic ones probably not at all, the infectivity thus depending upon the frequency with which the organisms are present in a surface lesion.

Diagnosis.—The earlier that a case is diagnosed as being syphilitic the better are the chances of success in treatment. The specific nature of the primary sore can generally be confirmed by the use of direct smears, with the detection of the organism. Here also the Wassermann reaction, if present, is of great diagnostic value although it is seldom positive in the first month. In the later stages this reaction is also useful in confirming a clinical diagnosis, but must be accepted with caution in the absence of clinical signs. Because a patient gives a positive Wassermann reaction it does not mean that any and every condition that he suffers from is syphilitic, and yet one often sees this unwarranted assumption made. Thus, in a case of Addison's disease seen not long ago the Wassermann reaction was strongly positive, but the patient did not improve under specific treatment, and at the *post mortem* examination tuberculous disease of the suprarenal capsules was found. It must also be remembered that, as Thaysen¹ has shown, the reaction may exhibit wide variations from time to time, even to the extent of being occasionally absent, apart from treatment.

Environment.—If all contagious cases of syphilis could be quarantined and kept there until they had been successfully treated the problem of the control of the spread of the disease would be a simple one, but such a Utopian idea is not possible in the present stage of civilization. In the Army, however, it is possible, and is done as a routine. In private practice the patient at least can be warned of the danger of infecting others, not only by intercourse but by any contact, and through the medium of dishes and towels.

It would be well if the law required a medical certificate before marriage in regard to this disease as well as in others, which, although perhaps not so serious, are equally contagious. This is now done, I believe, in some of the States of America.

¹Kilduffe, *Archives of Dermatology and Syphilology*, Aug. 22nd, 1922.

In the acute stage of the disease, and especially when there is any fever, the patient should be in bed.

Diet.—A patient with active syphilis should be kept upon a non-stimulating diet, and alcohol and tobacco must be largely interdicted. The latter, especially, will often cause syphilitic sores about the mouth to be much worse.

Specific Treatment.—There are three chemical elements which have a specifically destructive action upon the parasites of syphilis and upon the tissue proliferation around them. These are mercury, arsenic and iodine.

Until recent years, mercury locally and internally in the early stages and mercury and iodides in the later ones, were practically all that were employed, but now arsenic has come much to the fore and is perhaps the most important of the group at the present time.

Arsenic.—Although arsenic seems to be new in its use here, it has an ancient history. Thus we may read in the Edinburgh Medical Journal of May, 1810, the following from the pen of a Dr. G. N. Hill: "When syphilis resists mercury, arsenic will be found to have great advantages, affording very commonly a resource as much to be depended upon as its great precursor was in the more early and less obstinate stages of the disease. Ancient syphilitic ulcers, degenerated buboes and cutaneous eruptions of long standing will all yield to arsenic." But it was to the brilliant work of Ehrlich that we owe the reintroduction of arsenic in the treatment of this disease, and that in new forms which are more powerfully toxic to the parasite while being less so to the host than are any of the older preparations of the drug. Ehrlich first experimented in 1889 on trypanosome disease in mice. He tried a hundred synthetic compounds and then found a red aniline dye which would save fifty per cent. of the infected animals, while otherwise they would always die. Next, Thomas, of Montreal, noting that the best drug in trypanosome disease was arsenic, tried atoxyl in sleeping sickness and relapsing fever in man. Atoxyl (*sodii aminophenylarsonas*) contains 24.1 per cent. of arsenic, and yet is only about 1/40th as toxic to the host as the same quantity of arsenic. Atoxyl was also found to be of value in syphilis, but it soon became evident

that it was not a safe drug, and numerous cases of poisoning occurred, and it fell into disuse. Hata, a worker in Ehrlich's laboratory, tried to improve upon atoxyl, and at last produced dioxydiamidoarsenobenzol (laboratory number 592) and then its hydrochloride (606), which was given the trade name of Salvarsan. This preparation contained 31 per cent. of arsenic, and cured mice and rats of relapsing fever without poisonous effects. Then it was tried upon rabbits infected with syphilis and the spironemata disappeared in 24 hours. Next it was used in man, and here again the organisms usually disappeared, and, at least in early cases, the Wassermann reaction became negative and the patients were apparently cured.

At first it looked as if the ideal remedy had at last been found,—one that was parasitotropic 100 and organotropic 0. Further experience has shown, however, that while this preparation must be considered as the most powerful agent known against the infection it is not always parasitotropic, and is sometimes organotropic. Many cases of late syphilis resist its action, and numerous examples of severe and even fatal poisoning with the drug are now on record. At present it is customary to employ mercury, and often iodides as well, in addition to salvarsan.

Many substitutes for the original salvarsan are now in use, and new ones appear upon the market almost every day. In them all the arsenic is in a non-ionizable form, and is only slowly released in the body tissues. Certain organisms, such as the spironemata and the trypanosomes seem to decompose it more rapidly than the normal cells of the body, and hence are destroyed while the body cells escape.

Some of the best known of the newer preparations are diarsenol, neodiarsenol, neosalvarsan, arsenobilin, galyl, but their name is legion. They chiefly differ in their percentage of arsenic and in their solubility. Neo-silver-salvarsan has come into much favour lately.

Each one is supplied with minute directions as regards dosage and method of administration, and will not be further discussed here. The group name of salvarsan will be used for simplicity.

Salvarsan has been administered (a) subcutaneously in oily suspension, (b) intramuscularly, in suspension, (c) intravenously, (d) and lastly, by the bowel. It is by the intravenous method that the drug is now nearly universally given, although Col. Harrison, of the British Army, is much in favour of the intramuscular route. A safe and vigorous course of salvarsan between extremes is advised. Such a one is that used in the American Army and is as follows: 0.4 to 0.6 grms. at five day intervals for three doses; after that at week intervals for five more doses, making a total of 8 doses in 6 weeks. This is combined with an equal number of intramuscular doses of mercury. Early in the disease one such course may be curative, as judged by a negative Wassermann, but this is not safe, and in all cases the course should be repeated after a rest of two months. A further course may be necessary after another rest, and still further ones if required. But in tertiary cases it may be impossible to get a negative Wassermann, although we can probably get a qualitative improvement here, and we must rest content with a symptomatic cure. In obstinate cases showing signs of involvement of the central nervous system special methods of reaching the infection here may be valuable. One of these is the Swift-Ellis one in which salvarsan is given in the usual way, and an hour later some blood is drawn off from a vein and placed for 24 hours in a refrigerator. Then it is centrifugized and 12 mils of the serum is diluted with 18 mils of normal saline, and the mixture is heated at 56° Cent. for half an hour. Then a spinal puncture is done on the patient and this fluid is allowed to run in through the needle by gravity.

But the amount of arsenic thus put into the meninges is infinitesimal, and moreover, we have no reason to think that it reaches the nerve tissues by this route. The pressure in the cerebral capillaries is higher than that in the cerebrospinal fluid and hence the current is rather outwards than inwards. Moreover, F. M. R. Bulmer and the writer have shown experimentally¹ that arsenic injected into the meninges does not reach the central nervous tissue unless the dose be enormous.

¹*Transactions of Assoc. of American Physicians*, 1922.

Another and simpler method is to give salvarsan and then a few hours later to also do a spinal puncture. The idea is that the fluid that pours in from the choroid plexus to take the place of that removed will carry in arsenic. Now it has been shown that few drugs appear in the cerebro-spinal fluid, but that if the meninges be irritated then they tend to do so. After spinal puncture following the administration of salvarsan by a vein, arsenic will appear in the cerebro-spinal fluid to the extent of .25 parts per million. Barbat, in discussing this form of treatment, says: "I am not prepared to say that the arsenic which is thus made to enter the spinal canal is the dominating factor in this method of treatment. I believe that the antibodies residing in the blood serum and passing into the spinal fluid play a more important part than the minute proportion of arsenic we find."¹ This latter simpler method of reaching the meninges is certainly more widely available than the other, and in my limited experience produces just as good results.

In advanced syphilitic disease of the brain and spinal cord it is often unwise to attempt radical treatment.

It is interesting to note that in the first year after infection with syphilis, some 25 to 30 per cent. of all cases show pathological changes in the spinal fluid. In most of these no further trouble occurs, and it is, after all, only exceptionally that symptoms of serious involvement of the central nervous system appear even in untreated cases. This must be evident if we think of the commonness of the infection and the comparative rareness of evident cerebro-spinal disease. I am told by medical men from China that a large proportion of the Chinese have syphilis, and yet tabes and general paralysis of the insane are not common.

Salvarsan has been given per rectum. The first attempt was made by Geley and Luis de Portillo with arsenobenzol, and with arsphenamine by Azemar. Hajat reports 125 cases with the same results as by the intravenous route. He used novarsenobenzol. The selected dose (.9 gm.) is dissolved in 50 c.c. of recently distilled and sterilized water, and passed into the

¹*Jour. Amer. Med. Association*, I, 1919.

bowel through a gum-elastic catheter.¹ Or the drug may be given in suppositories. It may be well to remember this when for some reason the other routes are not available. Giving salvarsan by the bowel is, however, a very poor way of getting it into the blood, as we have found experimentally. Ehrlich originally advised the use of salvarsan only in cases that were resistant to mercury and iodides, but now it is used much more freely than this. The cases in which it should be avoided or only used very cautiously are the following: myocarditis and other serious diseases of the circulatory system, optic neuritis and advanced disease of the central nervous system, nephritis and most cases of albuminuria and non-syphilitic skin diseases. It was found in the British Army that the most serious symptoms following the use of salvarsan occurred in patients who had skin disease.

The toxic effects that occasionally follow the use of salvarsan are due to arsenic poisoning. Serious skin eruptions may occur, characterized by profuse shedding of the epithelium; gastro-intestinal disturbance, shown by nausea and perhaps diarrhoea; irritation of the renal structures with albuminuria, and multiple neuritis. When death occurs it may be with epileptiform convulsions and coma, exactly as in acute arsenical poisoning. In a number of instances jaundice has been produced and many deaths have occurred with symptoms and *post mortem* signs of acute yellow atrophy of the liver. In the fatal cases that occurred in military practice this was the usual cause of death.

Such toxic complications only rarely appear, but they show that the administration of salvarsan is not a procedure to be lightly undertaken. Experimental work has revealed that, following the administration of salvarsan, the liver is nearly always temporarily damaged, as shown by the levulose toleration test or the estimation of the fat-splitting ferment normally present in the blood. No clinical signs of this hepatic insufficiency occur and usually the organ is fully restored to normal within six months.² The drug should always be given in a

¹*Urologic and Cut. Review*, Jan., 1919.

²*Therapeutic Gazette*, Nov., 1922, p. 788.

small dose at first and should never be given or repeated until an examination of the urine shows this to be free from albumen.

Mercury.—This drug has been employed in the treatment of syphilis since the 16th century, and its use is one of the best examples of empirical treatment. For a few years it looked as if salvarsan would displace it, but now it is generally used along with this.

Some form of mercury is the best local application for open syphilitic lesions. The black wash (*Lotio Hydrargyri Nigra*) is perhaps the one most used here. For its general effect, mercury has been given (a) by the mouth, (b) through the skin, by inunction or by vapor, (c) by inhalation and (d) intramuscularly and subcutaneously.

(a) By the mouth. The solid preparations most commonly used here are the blue pill (*Pilula Hydrargyri*), calomel (*Hydrargyri Subchloridum*) and grey powder (*Hydrargyrum cum Creta*), all in doses of 1 to 3 grs. thrice daily after meals.

The fluid preparations most used are the *Liquor Hydrargyri Perchloridi* (1/16 gr. per drachm) in doses of 30 to 60 mins., and the *Liquor Hydrargyri et Arsenii Iodidi* (Donovan's solution), 12 mins. containing 1/10 grain of each salt, dose 5 to 20 mins.

(b) By the skin. The vapor method is not now used, but was common. It consisted in making the patient sit, surrounded by a sheet, in a vapor produced by heating 20 grs. of calomel in a metal dish, and then he was rolled in a blanket and lay still for an hour.

Inunction with the blue ointment (*Unguentum Hydrargyri*) is a very favourite method, especially in the treatment of young children. In these patients the best plan is to smear a portion of the ointment of about the bulk of a pea upon the skin and then place a binder over it. In the adult the daily inunction of a drachm of the ointment will soon get the patient fully under the influence of the drug. It should be well rubbed in for 30 minutes, taking a different part of the body each day, stopping on one day in the week and then giving a bath. Twenty-four applications are usually sufficient to get the full effects.

(c) Inhalation of mercury is now seldom employed. Three grains of calomel were heated in a saucer and the patient took 8 to 10 long inhalations of the white vapor.

(d) The intramuscular injection of mercury is now very much used. Half to 1 grain of the metal is suspended in liquid paraffin and injected deeply into the gluteal muscles. Or grey oil may be used. This consists of mercury rubbed up with wool fat and vaseline (0.4 grm. in 1 c.c.) Two or 3 mins. of this are injected in the same way. One to two grains of the salicylate of mercury suspended in 1 c.c. of liquid paraffin is a good preparation. The dose is usually repeated once a week, but for a time may be given every second or third day. The injection causes a good deal of pain.

Mercury is slowly eliminated by all the secretions and excretions in the form of an albuminate. About 1/16th of a grain of the metal can be thus got rid of each day, and if more than this is absorbed then it will tend to accumulate and sooner or later toxic symptoms will ensue. These toxic symptoms do not so easily occur if the patient be syphilitic. The toxins of the disease and the mercury seem in some way to neutralize each other. A few years ago an Italian physician found that if a given dose of mercury was given by the mouth the drug soon appeared in the urine, but if the individual was suffering from syphilis it did not so easily appear. He proposed this as a test for syphilis!

When a patient is taking mercury the mouth should be carefully watched and kept scrupulously clean, best with a mouth wash of potassium chlorate. Poisoning with mercury is specially apt to occur if the kidneys be inactive, as this is the route by which the drug is largely got rid of. Hence the urine should be constantly watched and the treatment stopped if albumen appear. The most common untoward effects are seen in the alimentary tract in the form of salivation, inflammation of the gums and loosening of the teeth, which may even fall out. Want of appetite, nausea and vomiting may occur, and diarrhoea is very common. Signs of poisoning may appear in the nervous system in the form of neuritis or choreiform movements or tremor resembling that seen in paralysis agitans. All these symptoms are or were commonly

seen in mirror-makers. It was formerly considered correct to push the drug in syphilis until toxic symptoms were produced, but this is not now purposely done. Sometimes a patient may very easily suffer from some looseness of the bowels when he is taking mercury, and this may often be easily controlled by small doses of Dover's powder,—say 1 grain with each dose of the mercury.

Mercury is much used in many other conditions besides syphilis, but it is here that its specific effects are most evident.

Recently Bismuth has been used a good deal in the treatment of syphilis, but as yet is in the experimental stage. It is usually given in a soluble form, intramuscularly. It does not make the Wassermann reaction negative so easily as salvarsan, but in resistant nervous lesions seems sometimes to be more efficient.^{1 2}

Iodine.—Iodine is too irritating to be itself given internally, but the iodides of potassium, sodium, and ammonium are much employed in the tertiary stage of syphilis. In some obscure way, possibly by stimulating the thyroid secretion, iodine tends to reduce inflammatory thickenings of all kinds, but very especially those produced by syphilis. When potassium iodide is freely given in a case where a visible gumma exists, this mass may be seen to rapidly melt away. Its action here is, I think, quite as rapid as after the use of salvarsan. Many believe that the drug acts only by making soluble any mercury that had been previously administered, and which was lying latent in the body. Possibly some of its action may be thus explained, but I have often seen the same effect where no mercury had been given. Some time ago, a boy of ten was admitted to the Children's Hospital with symptoms of a brain neoplasm, including optic neuritis, and retinal haemorrhages. Under large doses of potassium iodide alone the condition cleared up and he was able to return to school in a few months. A year or two later his father died of G.P.I. And recently we had a case where the patient, while undergoing salvarsan treatment, developed paraplegia, with complete loss of control of the bladder and bowel. She was put on daily inunctions of mer-

¹*Lancet*, April 14th, 1923, p. 761.

²*Therapeutic Gazette*, June, 1923, page 381.

cury and given 60 grains of iodide of potash thrice daily, and in two months the paraplegia had cleared up and a year later had not returned. The action of the iodides in syphilis may be well claimed to be specific.

The pharmacopoeial dose of each of the three salts is 5 to 20 grains, but these amounts may be greatly exceeded in syphilis without producing any untoward effects. One can easily give a drachm thrice daily in tertiary syphilis, and often the best effects are only obtained by such doses. It is commonly believed that the potassium base is depressing, but Professor Dixon points out that a vegetarian takes as much as two ounces of potassium in his day's ration without any depressing effects, so we need not trouble about the amount of this base that is contained in even large doses of the iodide. The iodides are rapidly eliminated, but are slightly cumulative, and hence it is well to break occasionally the monotony of many doses.

Strangely enough, toxic symptoms are more apt to occur from small than from large doses. I have seen such frequently from doses of 3 to 10 grains, but never from those of a drachm. The late Dr. Farquharson, in his book on Treatment, gave the strange rule that if toxic symptoms occur from the iodides one should stop or double the dose, and I notice that Sir Hale White, in a recent discussion in London, gave much the same advice. One of the worst cases of toxæmia from iodide that I ever saw occurred in a woman who had only taken five grains of the drug thrice daily for a day. She was covered with petechiae, and was very ill.

The symptoms of Iodism are usually those of a respiratory catarrh, but oedema of the glottis may even occur, especially where there is any syphilitic lesion here. Various skin eruptions are frequent. These are usually acneform or petechial, and there may be some cutaneous oedema.

The administration of the aromatic spirit of ammonia with the iodide is believed to lessen the tendency to iodism. The usual symptoms of iodism resemble those of a common cold. All the other manifestations are rare.

Various organic compounds of iodine are on the market. They are of two types:—(1) the iodized proteins, and (2) the iodized fats and fatty acids. They are all said to disturb

the stomach less than the alkaline iodides and to have less tendency to the production of rashes. The more stable ones are probably not entirely split up in the body and are therefore not completely utilized. The second group have possibly some advantage when the continued action of iodine is required, as in arterio-sclerosis, but in the treatment of syphilis we should rely on the inorganic salts.

Congenital Syphilis.—Before the age of one year this is usually best treated by inunction; after that by proportional doses of salvarsan and mercury. Of course the mother should also be actively treated.

Nowadays, one sees many series of results of the routine Wassermann testing, and it is astonishing how frequently this proves to be positive where there is no history nor yet any signs of syphilis. The question naturally arises whether all these people should be declared to be syphilitic and subjected to a prolonged course of salvarsan and mercury in the hope of rendering the Wassermann reaction negative. At present the facts do not justify such a step. It would mean the treating of a large percentage of the total population as syphilitic. Probably, all young people, who show a positive reaction, should be actively treated, but in those past middle life, where there are no signs or symptoms of syphilis except a positive Wassermann reaction, such a step is very doubtful.

On the other hand, symptoms of syphilis may be present, and yet the Wassermann reaction may be persistently negative, and such cases should be treated as long as any symptoms remain.

As regards the marriage of syphilitics, the physician should insist upon at least three years elapsing from the date of infection before he gives his consent. His advice will often be ignored, but at least he will have done his duty. Even after three years, marriage should not be agreed to unless the patient has been thoroughly treated and has been free from symptoms for at least a year.

CHAPTER VII.

DISEASES OF THE RESPIRATORY SYSTEM.

PLEURISY. EMPYEMA. HAEMOTHORAX. PNEUMOTHORAX

PLEURISY.

Inflammation of the pleura may be acute or chronic, and in either case the affection may be "dry" or "with effusion."

ACUTE DRY PLEURISY.—Here the symptoms are pain in the side aggravated by breathing and coughing, a suppressed cough and some fever. The characteristic physical sign is fine friction.

Diagnosis.—The diagnosis of acute dry pleurisy is generally an easy matter, but the underlying cause must also, if possible, be found. The condition usually is present when there is pneumonia, but apart from this the great majority of cases are tuberculous. Often it appears that this infection is limited to the pleura, although some more distant local source of infection, such as the lung itself, should always be suspected.

Environment.—The patient has fever and should be in bed, but there should be an abundance of cool, fresh air permitted. The quieter he is kept the better, as any attempt at talking will probably bring on a fit of coughing, with much resulting pain.

Diet.—A light diet, suitable to the condition of fever, is best.

Specific Treatment.—In some rare cases the underlying cause is rheumatic fever, in which case a course of the salicylates (page 85), will be of value. Beyond this it is not possible to treat the condition specifically.

Symptomatic Treatment.—The ordinary course of a dry pleurisy is to clear up after a few days, probably leaving behind some light pleural adhesions. But during these few days the patient will suffer much if not cared for, so that symptomatic treatment is of value here. The symptoms, as

mentioned, are some fever, pain (made worse by breathing and coughing), and the cough. Nature tries to rest the affected side by reducing the movements here, and we can encourage this by strapping. Strapping two inches wide should be put on in strips, each overlapping the one above. They should be applied horizontally, and then (as the ribs run obliquely), they will each cross several ribs. They should be applied while the chest is in the position of full expiration. Each strip should reach slightly beyond the middle line in front and behind. Or instead of the strapping we may apply heat or cold. The heat is best used in the form of a turpentine stupe (page 50), or a Scotch stupe. This latter is made by simply damping a cloth with turpentine and applying it directly. It is a strong counter-irritant and must not be left on so that the skin blisters. Or a mustard poultice may be used. This is made by mixing mustard in twice its bulk of linseed meal and then making a paste with hot water, and spread on a cloth. Over its surface is put a layer of cheese cloth and then it is applied over the painful area. A mustard poultice should not be left on for more than half an hour and the patient should not go to sleep with it in position. The first effect of the mustard is to irritate, but next follows an anaesthetic action and the mustard may blister deeply without causing any pain. Especially is it necessary in children to avoid doing harm with mustard.

In Germany it is common to use an ice bag here. The ice bag should not be very full and should be changed as often as all the ice melts.

Dry cupping will often much relieve the severe pain (page 100). Or the application of a few Leeches. The medicinal leech (*hirudo medicinalis*) in old days was much used in medicine—indeed the physician was often called “the leech.” But it went out of favour for a time, and during all my student and house-physician days in Edinburgh, I never saw a leech applied. But in the last few years the leech is coming into use again and is often of value. When applying a leech there are several little things to observe. In the first place it should be kept out of the water, in which it will have been sent by the druggist, for half an hour or so before being used. Next the

skin should be washed with water, but without soap. Smearing the skin with a little milk is sometimes useful in order to make it bite better, but the best of all is to prick the skin and smear the blood around the spot. Do not handle the leech in your fingers, but put it into a test-tube and then shake it against the skin. When once it bites it will usually extract from one to two drachms of blood, and will then drop off. The wounds are apt to continue to bleed, and to avoid this should be dusted with dry alum and then pressure applied. It is necessary to see that all bleeding has stopped before the physician leaves his patient, as severe bleeding has followed this neglect.

Any of these local treatments will considerably lessen the pain, but it is often necessary at first to give a hypodermic injection of morphia. After that the patient may have a simple fever mixture to which it may be advisable to add a little opiate, such as 20 drops of paregoric to each dose, in order to lessen the cough. The cough in pleurisy does not seem to serve any useful end, and hence may be freely checked. Usually, as said, a dry pleurisy remains dry to the end and subsides after a few days with the probable production of adhesions, but it often goes on to effusion.

ACUTE PLEURISY WITH EFFUSION.—This usually begins as a dry pleurisy, but may apparently, in some cases, at once proceed to effusion. There is fever, but not so much cough or pain, as now the two layers of the pleura, being separated by a layer of bland fluid, do not rub and irritate each other.

Diagnosis.—Here, again, the commonest cause is tuberculosis, but other infections may be to blame and the exact cause is best ascertained by the withdrawal of a little of the fluid and examination in the laboratory.

Pleural effusions may be considered from the point of view of treatment in three classes,—small, medium and large. The small being those in which the fluid does not extend above the angle of the scapula; the medium where it is not above the middle of the scapula, and the large where it is higher than this.

Environment.—The patient should be in bed as long as there is any fever.

Diet.—It is often taught that the fluids should be greatly restricted, with the idea that this will cause absorption of the effusion, but it is doubtful if it has that effect and there seems to be no necessity for making the patient thus uncomfortable. A light diet will be needed as long as he has fever.

Specific Treatment.—In most cases of pleurisy with effusion, after we have the patient in bed on a light diet and probably have given him a simple fever mixture, all has been done that is required. The bowels should be kept rather freely open with concentrated salines. Usually after the effusion has been there for a few days it will rather rapidly disappear. When it is small and does not quickly disappear, then probably we can hasten it by the use of counter-irritation, either with iodine or fly blister. When the effusion is a medium or large one and does not disappear within, say, two or three weeks, it will often be necessary to remove it by paracentesis.

Paracentesis.—When it is decided to use this, the skin over the point to be entered should be sterilized with tincture of iodine or alcohol. It is best always to confirm the diagnosis of fluid with a syringe, not only to make sure that it is really there, but also because if it turns out to be purulent then it may require surgical treatment. The aspirator is the instrument usually used for the removal of fluid. Most aspirators are made in such a way that it is possible to so adjust the tubes to the bottle and the pump that air goes *into* the bottle instead of out of it. All risks may be avoided if the doctor will always test the instrument first with the needle immersed in sterile fluid. It is as well to first use a local anaesthetic, such as a 2 per cent. solution of novocaine, which is better than freezing with ethyl chloride. A moderately negative pressure is all that is required to remove the fluid. The needle should be introduced in the 8th interspace just outside of the angle of the scapula. Keep well to the lower part of the space so as to avoid the possible wounding of the intercostal vessels and nerve. The needle should be directed downwards and inwards towards the base of the lung. If the fluid turns out to be bloody it is well to stop the aspiration.

But as a rule it is not necessary to use an aspirator for the removal of thin fluid from the chest. A much simpler and

rather safer plan is to siphon it off. Here we use a needle as before, but attached to it is a small rubber tube about three feet long. This has previously been sterilized and filled with sterile water and clamped. As soon as the needle is *in situ* the clamp is removed and the fluid runs down the tube into a receptacle placed below the patient.

In the consideration of an individual case of pleurisy with effusion the question of removal of the fluid often is for a time in doubt, and it is well to consider the arguments for and against it, and then try to lay down some general rules for our guidance.

The dangers of paracentesis are (a) syncope. This is very rare, but fatal collapse has occurred, especially when a large effusion has been quickly removed. It is always well to have a stimulant at hand, and when dealing with nervous patients to give them a $\frac{1}{4}$ grain of morphia, half an hour before the operation.

(b) Rupture of the lung. This is a rare complication, but it has occurred after the removal of an effusion following pneumonia. A pneumothorax ensues.

(c) Expectoration of a large amount of albuminous fluid, with other signs of acute pulmonary oedema.

(d) Infection of the pleura. This should not occur, but there is always the possibility.

The objections to leaving an effusion for long are:—(a) that permanent collapse of the lung may occur, (b) that the fluid may interfere with the heart's action, (c) the protraction of the case, for as long as a patient has fluid in the pleura he is an invalid.

Some physicians would tap a chest almost as soon as any fluid is discovered, while others will leave this for many weeks before mechanically removing it, but when one considers, as Sir Thomas Horder puts it, that "the evolution of the process of exudation is not usually complete before the tenth day," it is evident that removal of fluid before that day, except in emergencies, is likely only to be followed by recurrence. Probably the following rules will be the average opinion of the majority and they certainly are, to my mind, the correct ones.

(1) Tap when the fluid is up to, or above the third rib in front and shows no sign of decreasing at the end of three weeks. If the effusion is less than this then we may well delay a little. If, on the other hand, it is up to this level, and yet shows any signs at all of going down, then delay, for usually when the absorption once starts it goes on rapidly. Often the mere exploratory puncture used to ascertain the nature of the fluid seems to initiate this turn of the tide. I remember once examining a patient on a Sunday, who had an effusion up to the middle of the scapula. It had been there for three weeks and we put a needle in and found that the fluid was clear and sterile. We decided to tap the chest on Tuesday, but when she was brought into the theatre before the class, the fluid was found to have all disappeared in the 48 hours.

(2) If the heart's action is at all interfered with by a pleural effusion of *any* size or of any duration, then tap at once. The size of an effusion is, as a rule, not of so much importance here as is its speed of accumulation.

(3) Tap even a small effusion if it persists for weeks in spite of all counter-irritant and other treatment.

(4) Do not be in a hurry to tap if the fluid be blood-stained or if the lung be decidedly tuberculous. Blood staining usually indicates either an acute tuberculous condition of the pleura, or else malignant disease here. An effusion often does good when the lung is tuberculous, and it therefore should not be interfered with unless it is producing urgent pressure symptoms. Also, if a tuberculous lung be quickly expanded we may disseminate the infection in the blood. All tuberculous foci, wherever situated, must be handled with great care on account of this danger.

CHRONIC PLEURAL EFFUSION.—This is usually a sequence of the acute form and merely represents this at a later stage, when acute inflammation of the pleura has subsided and yet the fluid remains unabsorbed. But not uncommonly one finds even large accumulations of fluid where there has been no such acute onset. The condition appears to have come on gradually, and has produced no symptoms beyond some limitation in the range of respiratory capacity. I remember a medical student

coming with the complaint of shortness of breath on exertion, but nothing else. He had had no acute pleurisy and had not laid up at all. The right chest was absolutely full of fluid.

Fluid in the chest is often, of course, a transudate in heart and kidney disease.

Diagnosis.—This is an easy matter. The condition is usually tuberculous and the fluid will be clear and sterile (usually). The percentage of albumen varies, being higher in pleuritis than in the transudation. The white cell count is low and chiefly consists of mononuclears.

Diet.—Feed the patient up in every way, and often he will need iron.

Specific Treatment.—None.

Symptomatic Treatment.—The fluid must be removed, and usually either this is done by aspiration or by syphonage as already described. But here it is very apt to recur, and it is then well to either do a replacement with a gas or this *plus* the introduction of adrenalin solution.

Replacement of Fluid with Gas.—When an effusion has been removed by aspiration or syphonage, it is evident that a negative pressure has been re-established in the pleura, and this is apt to cause the effusion to recur. If, when we remove the fluid, we replace it with some gas, the lung remains collapsed, and only expands slowly as the gas is absorbed. There are several modifications of the method by which this replacement may be done.

(1) The simplest is to aspirate or syphon off as much fluid as will come away, and then attach to the tube going to the needle an air-filter, made by filling a glass bulb with sterile absorbent cotton. Air will then rush in and the lung will again collapse and the pressure in the pleura will become that of the atmosphere. The needle is then withdrawn and the puncture sealed with collodion. A disadvantage of this method is that the lung is first expanded and then collapsed, which may stir up infection in it.

(2) By having a two-way cock connected with the needle. Some fluid is drawn off and then some gas is let in, and so on until all the fluid has been replaced by the gas. Here, again, the lung is disturbed, alternately being somewhat expanded

and allowed to collapse. The objection may be theoretical, but it seems wise to avoid this, as can easily be done.

(3) Another, and to my mind the best way of replacing the fluid by gas, is to aspirate or syphon from the lower part of the pleura as usual, and at the same time to have a small needle in the upper part, through the second space anteriorly, so that the gas enters in proportion as the fluid leaves the pleura. This upper needle need be only of small calibre and gives no more pain in its introduction than a hypodermic needle does. It may merely be connected with an air filter, although it is more scientific and satisfactory to have it connected also with a manometer, so that the pressure in the pleura may be watched. The quantity of gas that has been introduced may be measured.

By this method the lung never expands at all during the operation, but only gradually as the gas is absorbed.

As to the question of what gas is best to use in this replacement, opinions vary somewhat. Oxygen, nitrogen or a mixture of these (namely air) may be used. Nitrogen is said to be absorbed more slowly than oxygen, while, of course, air occupies an intermediate place. But it has been shown lately that there is not much, if any, difference in the time of absorption. Oxygen has a special action in being stimulating and antiseptic. Filtered air is usually the most convenient gas to use.

With simultaneous removal of fluid and replacement with gas, there is little distress produced. I remember one soldier in France from whom we thus removed 108 ounces of fluid at one sitting, and during the operation he was quite happy and smoked cigarettes the whole time.

Occasionally an effusion will recur, even when it has been replaced with gas. It was Sir James Barr of Liverpool who suggested that in these cases the introduction of $\frac{1}{2}$ -1 drachm of 1-1,000 solution of adrenalin chloride, diluted in thrice its bulk of normal saline, has in some way a deterring effect upon the recurrence of the effusion. After the pressure in the pleural cavity is that of the atmosphere, the air filter may be removed and a small funnel attached to the tube, through which this solution can be allowed to run into the cavity. I

have tried this treatment often and believe it is of some value in lessening the tendency to recurrence of the fluid.

EMPHYEMA.

When the fluid in the pleura is found to be purulent or semi-purulent it is usually right to look upon the case as surgical and to drain, generally with resection of a rib. After this the lung may be encouraged to expand by breathing exercises, especially by blowing efforts, such as blowing water from one large bottle to another.

There are some exceptions, however, to this rule of immediate surgical interference in every case of empyema.

(1) If the empyema follow a frank lobar pneumonia, especially in children, the chest should be aspirated at least once, if not oftener, before the more serious operation of drainage is resorted to. Many cases will recover under this treatment. Even in adults this may be tried, at any rate once. During the recent war I saw it successful many times.

Again, in empyema, following influenzal pneumonia, it is usually better to aspirate and to repeat this several times if required. Some physicians, after the aspiration, inject some antiseptic, such as a 2 per cent. formaldehyde solution in glycerine.

Some of these cases may be completely relieved by this simple procedure, and if drainage has eventually to be done the patient is in a much better condition to stand the operation, and probably the empyema will now only be a local abscess, and hence much more easily and safely attacked than when the whole pleura was involved. In military practice in the influenza epidemic of 1918-19 this method of handling the empyemata gave a much lower mortality than did early resection.

Often, after influenza, the empyema is localized and several pockets of pus may require separate attention. Such collections of pus may spontaneously open into the bronchial tree and thus be evacuated, but such a termination should never be waited for if they can be reached by the needle or knife.

(2) When an empyema occurs in a phthisical patient one should be slow about attacking it surgically, especially by resection, as a sinus is apt to form and not close, and the case does badly.

Often an empyema is localized and lies deeper than the parietes and may be difficult to find even with repeated needling. The X-ray is of great service here and should be freely resorted to when pus is suspected.

HAEMOTHORAX.

This is a rare condition in civil practice, but very common in war time. The blood usually comes from the injured lung, although it may come from an opened intercostal artery.

Environment.—The patient should be kept absolutely quiet, morphia, if necessary, being used to attain quietude.

Diet.—Light.

Specific Treatment.—None.

Symptomatic Treatment.—Probably most of the infected cases (and this is ascertained by the use of an exploratory needle and then culture of the fluid), should be opened and drained, or otherwise surgically treated. This is certainly right when the infection is found to be streptococcal. When it is influenzal or pneumococcic it has probably come from the lung and then we need not hasten, but can try simple aspiration first.

Small effusions of blood which are sterile, say those not reaching above the angle of the scapula, need not be aspirated, but can be left to Nature and will be slowly absorbed. When the fluid is higher than this, it should be removed, but it is well not to attack it until a week after the injury. Then it should be done by gas replacement as already described (page 126). In some cases the blood has coagulated *en masse* and then cannot be so removed. These cases, if the clot be small and aseptic, may be left to Nature, but if the mass be large, and if there be any infection, it may be necessary that the chest be opened and all the clots removed.

PNEUMOTHORAX.

This also is a rare disease in civil practice. When it occurs as a complication of phthisis it is usually infected and becomes a pyopneumothorax. But occasionally it does not so result, and in that case may do good. The observation of this fact led to the treatment of suitable cases of phthisis by the production of artificial pneumothorax.

Aseptic cases of pneumothorax, even when associated with a small haemorrhagic effusion, require no special treatment, beyond the general ones of rest, etc. In rare cases the air may be under such pressure that it may cause embarrassment of the heart. Here, all that is required is to introduce a cannula through an intercostal space, when the pressure will become that of the atmosphere and the embarrassment will largely cease. The septic cases due to traumatism require drainage.

CHAPTER VIII.

DISEASES OF THE RESPIRATORY SYSTEM.

ASTHMA. CROUP. LARYNGISMUS STRIDULUS. WHOOPIING COUGH.

ASTHMA AND HAY FEVER.

THE exact nature of Asthma is not definitely known, and probably is not the same in every case. Some would have it that the condition is really an angioneurotic oedema of the bronchial tract, and when the condition occurs as part of an anaphylactic attack this seems likely to be the case. But usually there probably is a spasm of the smaller bronchial tubes. Normally these tubes contract to a slight extent rhythmically, and this normal contraction becomes greatly exaggerated in an attack of asthma. But that there is also some vascular or even inflammatory change is rendered likely by the fact that after an attack the patient brings up sputum which contains Curschmann's spirals and many eosinophiles, and there is also a marked eosinophilia of the blood (25 to 40%). It is interesting to recall that *eosinophilia* occurs in anaphylaxis.

Two factors are concerned in the production of bronchial spasm:—(1) The amount of irritability of the neuro-muscular apparatus, and (2) The amount of reflex irritation that is present. The first factor, the degree of irritability of the neuro-muscular apparatus, may be due, (1) to inheritance, and 40% of asthmatics have a family history of the trouble; (2) to certain poisons, especially those of uraemia, and gout; (3) to a nervous strain, which, by racking the nervous system makes this more irritable.

The second factor, the reflex irritation, may be from abnormal conditions in the nose, teeth, skin, uterus, stomach and very especially the bronchial mucous membrane.

If the irritability of the bronchial neuro-muscular apparatus be very great then it scarcely requires any reflex irrita-

tion to set up the spasm, while on the other hand if the irritability be slight, as is the case in the normal individual, it will require some very exceptional reflex irritation to bring about a spasm.

Hay Asthma much resembles asthma, and here we have certainly a congestion of the nasal mucous membrane, and Sir Andrew Clarke suggested that the same condition low down in the respiratory tract was probably the essential cause of asthma.

Hay fever seems due to the pollen of certain plants. The Spring type is usually caused by pollens from grasses, while the Autumn one comes from the rag weed, golden rod, and maize, especially the first of these. The exact cause may often be determined by intradermic injections of extracts of the different pollens, and when the offending one has been found, immunizing treatment may be used by inoculation with the appropriate extract of the pollen.

Treatment Between the Attacks.

Diagnosis.—There are few diseases in which it is more important for the practitioner to get to the bottom of the source of the trouble than in the case of asthma and hay fever. By discovering some removable cause he may at once cure the case, when otherwise it may resist all his treatment.

Sensitiveness to certain proteins is being more and more recognized as a common cause of asthma, these proteins acting, perhaps, but not necessarily, in an anaphylactic manner. They may gain access to the body by inhalation, as in the case of pollens, feathers and skin emanations; be ingested in foods, or be produced by bacterial action in the bronchial mucous membrane, or less commonly in connection with the teeth, tonsils or some other focus. No case of asthma can be considered to have been properly studied until the reaction to skin tests of various proteins has been tried. Most cases of the disease beginning in early life seem to be of the nature of protein sensitiveness, but later on such a cause is less likely. Many series of cases have been published showing the percentage of asthmatics who give skin reactions. One of the largest

of these is from the Mayo Clinic¹, where some 800 patients were tested in two years. Of these, 500 were completely negative in their skin reactions, and another 100 were doubtful. The largest number of the positive results were to horse dandruff. Not one reacted to *staphylococcus aureus* or *albus*. Thus one may conclude that a very large group of cases of asthma are not due to protein sensitization.

Environment.—It is essential that in undertaking the care of a case of asthma, the surroundings that will best suit him must, if possible, be ascertained. Often, by merely changing these the patient may at once get rid of his trouble. Hospital physicians know how difficult it is to get a case of asthma to demonstrate to their classes, as the mere fact of coming into a hospital will often cause the attacks to cease. The proximity of stables, the presence of a cat or of certain flowers in the house may be sufficient to cause attacks. A feather bed has often proved to be the special *bête noire*. Graves related how in one day he came across two cases of asthma; one always got an attack when his chimney smoked, while the other was only free from it under such conditions.

Usually speaking, a mild equable climate will be the most likely to suit these cases, especially those due to bronchitis (bronchitic asthma); but climate here is largely a matter of individual experiment. I once knew a mother and a daughter, both victims of the disease, who scoured Europe in the hope of finding a climate which would suit them both. They did not succeed in discovering one which suited them both at the same time and eventually, as a compromise, returned and settled down in the rather smoky atmosphere of home in a large town in the Midlands. As a rule, as one might expect, the bronchitic cases are better in summer than in winter, but on the other hand the sufferers from hay asthma dread the summer, when the pollen of certain flowering plants causes them all their distress. The effect of sea air is uncertain.

Gentle exercises in the open air and special breathing exercises have their value here, as have also cold baths and douches, followed by friction. These all act by raising the general health.

¹*Medical Annual*, 1921, p. 62.

Electricity has been much advocated, and in an evidently neurotic condition like this it must often have a powerful psychic effect. The Faradic current, high frequency current and the Galvanic current have all been used with success in the hands of experts.

Diet.—The diet is often a most important thing in asthmatics. Many people only have attacks when they have eaten some special article of food. Generally speaking, it is well that the heaviest meal should be taken in the middle of the day. While idiosyncrasy is very marked here, as a rule the diet should be simple and easily digestible; and such things as pork, hard boiled eggs, pickles, cheese and shell fish should be avoided. Tea, coffee and alcohol are largely interdicted, although during an attack they occasionally are of some value. If the patient is too stout then a diet of lean meat, a saline every morning and the free drinking of water between meals is often of value. These stout patients also benefit by regular exercises. Foods that cause flatulence should always be avoided.

A diet composed of nothing but plain milk, taken for several weeks on end, may completely clear up some of these "Peptic cases" of asthma.

Removal of the Cause.—As already said, in every case we must endeavor to find the special cause of the attacks and often by removing such, which may in itself seem very harmless, we can cure the case. If the patient be found to be sensitive to some protein this should be avoided if possible, or an attempt be made to desensitize him by gradually increasing doses of it.

The injection of Peptone is often of value and may cure cases, especially those who are otherwise in good health and show little signs of bronchitis or emphysema. As a rule there should be three days between injections.

Often the disease is associated with some abnormality in the nose and the removal of this may effect a cure, but the wholesale attacking of every slight abnormal condition here by surgical means, can only be condemned. Much harm and only occasional good is done by the indiscriminate use of the galvano-cautery in such cases. When a bronchitis exists and

the organism can be isolated, a vaccine made from it may be useful.

Where the irritability of the nervous system is due to gout this must be treated *secundum artem*, and these are the cases amongst others that are so greatly benefited by long courses of iodide of potash.

While often it is possible to remove the special *bête noire* of the patient or to treat some physical condition that is reflexly causing the attacks, in many instances, it must be admitted, especially where there is a strong hereditary tendency, that we cannot thus remove the cause, and then it only remains to treat the cases symptomatically by drugs.

Many drugs have been recommended for the relief of asthma, and their very number is an indication of how uncertain the results are. In most cases their use is quite empirical, and they must be judged entirely by results. Potassium iodide is the one most frequently used and should be given continuously for weeks in small doses, say two to five grains thrice daily, best between meals. Some prefer to give it in a single large dose at bed time. The disagreeable taste is well covered with liquorice or ginger, or it may be agreeably given in milk. Arsenic is much used, in doses of two to five minims of the Fowler's solution, and may be combined with the iodide. Their mode of action is quite obscure. Belladonna is frequently employed and Atropine certainly has a paralysing effect upon the terminations of the vagus nerves in the lung. It has been shown by Dreser that electrical stimulation of the vagi causes contraction of the bronchial tubes, but this does not occur if the animal be previously treated with atropine. The tincture of belladonna may be given in doses of 10 minims, t.i.d. The bromides are frequently useful, especially in decidedly nervous cases. A useful prescription is the following:—

R	Strontii Bromidi	̄ ss	15.00	gm.
	Potassii Iodidi	5 ij	8.00	“
	Liquoris Arsenicalis	3 i	4.00	c.c.
	Syrupi Zingiberis	̄ i	30.00	“
	Aquae ad	̄ vi	200.00	“

Misce, fiat mistura.

Sig.—A dessertspoonful thrice daily in water after meals.

Many other drugs have been used here, but the ones mentioned are those most commonly employed.

Treatment During a Paroxysm.

During a paroxysm of asthma the patient presents, in the words of Bamberger, "the picture of a most laborious, tormenting, and, at the same time, fruitless struggle." He is suffering from want of oxygen and retention of carbonic acid gas and other waste products, and the air of the room consequently should be as pure as possible. It will often be found that the patient himself struggles to an open window. The chest will be seen to be in a position of full inspiration, the difficulty being always to get the air *out* of the chest.

The Nitrites are usually the first thing tried here, and they are often rapidly followed by relief of the spasm. Amyl nitrite, in three minim doses, inhaled from a handkerchief, should be given at once. It may be repeated several times, the only objection to its free use being the headache that is apt to result. The headache is less apt to occur if the drug be inhaled through the mouth.

Nitroglycerin, in doses of 1/100 grain (0.0006 gm.) by the mouth acts in the same way as does the amyl nitrite, but it is less powerful here, probably because the latter is inhaled and hence acts partly directly upon the contracted tubes.

Chloroform is a valuable antispasmodic, and may be safely inhaled, if the patient be allowed to merely wet the inside of a tumbler with it and then cork the bottle before beginning the inhalation from the tumbler. There is little likelihood of the habit being formed.

An immense number of inhalations have been introduced and largely used, many of them being patent "asthma cures." Most of them owe any efficacy they may possess to the fact that they contain *datura stramonium*, *lobelia*, and nitrate of potash. They are burned and the fumes inhaled. Sir James Sawyer points out that the popular knowledge of such fuming inhalations dates from over forty years ago, when the late Earl of Beaconsfield used them in his last illness. They were then frequently mentioned in the lay press and thus became

advertised. Such a powder as the following is a good one, and represents about the average composition of many others:

R Potassii Nitratis
 Pulveris Anisi Fructi āā ȝss 15.00 gm.
 Pulveris Stramonii ȝi 30.00 "
 Misce, fiat pulvis.

Sig.—A teaspoonful to be burned and the fumes inhaled through a paper cone during an attack.

Cocaine is a valuable remedy in hay asthma. It may be used either as a spray or else painted on the nasal mucous membrane. If it be desired to use the drug as a pigment for the nasal mucous membrane, it should be as a solution of two to five per cent. strength in water or albolene. Cocaine, however, is a most insidious drug and, if used in a disease which is apt to be of such long duration as asthma, may become a habit. Of all drug habits, the cocaine one is probably the most easily and quickly acquired and is the most distressing and hard to get rid of. Hence the physician who decides to prescribe the drug should do so with a full understanding of the risks, and at least should always mark his prescription with the words *ne repetatur* in order to lessen the chance of the patient getting it repeated without an order. So much has the danger of the drug been impressed upon the Canadian Government that no patent medicines containing it may be sold in the Dominion under any circumstances.

Adrenalin chloride is greatly used in paroxysms of asthma and in the distress of hay fever. The drug, according to Abrams, evokes the lung reflex of contraction, which permits the longitudinal fibres of the bronchial muscular coat to expel the residual air imprisoned by the spasm of the circular fibres. Another suggestion is that it relaxes the bronchial muscles through sympathetic stimulation.

Adrenalin may be used both as a spray and internally. Probably it is when given hypodermically that it gives the best results. Three to 10 minims (0.2 to 0.6 c.c.) of the chloride solution (of 1 in 1,000 strength) may be given hypodermically and it is seldom necessary to repeat the dose. The susceptibility of individuals to the action of adrenalin varies greatly and I

have seen patients only relieved when they were given over 20 minims.

As much larger doses than this of adrenalin, when given by the mouth or even hypodermically, have no decided effect upon the blood pressure, apparently the action in asthma is not a vascular one at all.

Perhaps the most reliable way of checking an attack of asthma, however, is by the hypodermic use of Morphia, either alone or, better still, combined with atropine. For obvious reasons a patient should not be entrusted with a hypodermic syringe, but the physician may use it for him. A quarter of a grain (0.016 gm.) of morphia combined with 1/150 grain (0.0004 gm.) of atropine may be sufficient, but it is often necessary to repeat this at the end of an hour or two. Morphia should not be too freely resorted to on account of the rapid dependence that the patient soon develops upon the drug. It is only in very bad attacks and when all other methods (except perhaps the use of cocaine) have been tried in vain that one is justified in using it.

Heroin (diacetyl-morphine) in doses of 1/24 to 1/8 gr. (0.0025 to 0.008 gm.) of the hydrochloride has been much recommended lately in place of morphia. Stengel, in editing the article on asthma in Nothnagel's *Encyclopaedia of Practical Medicine*, says that "the consensus of opinion seems to speak for the efficacy of the drug, while recommending that, as a derivative of morphia, it should be dispensed with discrimination."

Pilocarpine nitrate, in doses of 1/20 to 1/10 gr. (0.003 to 0.006 gm.) hypodermically, is occasionally useful in a paroxysm. The smaller doses should be used in a patient who has not taken it before, as occasionally a large one may produce untoward results in the form of a pouring out of bronchial secretion sufficient to embarrass the respiration, which already has so much to do.

Aspirin and novaspirin have lately been tried a good deal in the treatment of asthma and apparently have some effect in relieving an attack and even in averting it, if taken when the first threatening occurs. Aspirin is believed to act by

reducing the excitability of the nervous fibres in the bronchial muscles, with a consequent arrest of the spasm.

Chloral hydrate is an old favourite in the therapy of attacks of asthma. It should be given cautiously in ten-grain doses, which may be repeated every hour for several doses. It is rather an insidious drug and should not be put too freely in the patient's hands.

Emetics are occasionally useful, especially when the directly exciting cause of the attack is an indigestible meal. They are, however, depressing, and if the heart be weak may cause serious collapse. Ipecacuanha in doses of 20 grains (1.3 gm.) is perhaps the best here. Probably, however, the therapy of asthma would not lose much if emetics were never used.

Local Applications.—Local applications of heat to the chest, in the form of simple fomentations or, better still, as the turpentine stupe, are useful and comforting during the attack. The placing of the feet in hot water or a mustard bath, made by dissolving a tablespoonful of mustard in it, is useful as a derivative.

An attack of asthma is practically never fatal.

A good, immediate prognosis may be given in even the most desperate attacks, as they are self-limiting, the cyanosis bringing about relief of the spasm. But repeated attacks tend to wear the patient out, and, moreover, gradually lead to emphysema and dilatation of the heart. Hence, from a life insurance point of view, asthmatics are not "first-class risks."

SPASMODIC CROUP.

This is a very common complaint in children and the cause of many a night visit for the family doctor. The tendency runs in certain families. Whenever some children get a "cold" the infection travels to the larynx. In the day time they will be a little hoarse, but during the night may waken up with a laryngeal spasm, producing the well known croupy inspiratory crow and croupy cough. The condition generally lasts for three nights and then clears up. It is never fatal, but gives rise to very terrifying symptoms of asphyxia at the time.

Diagnosis.—This is usually easy, although the practitioner must bear in mind the possibility of laryngeal diphtheria and also of true laryngismus stridulus.

Environment.—During an attack the patient is best in a warm room with steam from a kettle in the vicinity. Often a hot bath is of value. Hot compresses round the throat are useful.

Diet.—Nothing special.

Removal of Cause.—Best considered under symptomatic treatment.

Symptomatic Treatment.—Besides heat, both externally and by inhalation, the best thing to do is to at once give a drachm of *vinum ipecacuanhae*, and repeat this every fifteen minutes until the patient vomits or the attack ceases. This is not too large a dose for a child one year old. The general relaxation that accompanies nausea and vomiting relieves the laryngeal spasm. It is well also to then give a dose of calomel and to continue the ipecacuanha wine in dose of 5-10 mins every four hours for the next day or two. A couple of grains of phenazone at bedtime for a child of 2 years will often avert a threatened attack. Children grow out of the tendency to croup. It never seems to occur in adults.

LARYNGISMUS STRIDULUS.

This very serious affection occurs in rickety children, and is usually associated with enlarged thymus and the so-called “status lymphaticus.” A rickety child in which there is a history of such spasms should be watched with care as it may require tracheotomy at any time. Short of that the treatment is the same as in croup.

WHOOPING COUGH.

This epidemic disease is probably due to an infection of the upper air passages with the bacillus of Bordet and Gengou. After a few days of what seems like a simple catarrh of the upper air passages, the cough becomes more and more paroxysmal and soon an inspiratory stridor develops and often a paroxysm ends in vomiting. The disease is largely one of childhood but occasionally it may occur even late in life. The

spasms cause much cyanosis but this very cyanosis brings about a relaxation after a time, and thus the paroxysms are never directly fatal. The chief cause of the considerable mortality in pertussis is catarrhal pneumonia. Under two years of age it is one of the most fatal infections, on account of this complication.

Diagnosis.—Usually this is at first in doubt but gradually a diagnosis of pertussis becomes probable and at last in typical cases certain.

Environment.—While there is any fever, which is apt to be the case at first, the child should be kept in bed. Later on an abundance of fresh air is valuable, but any taking of cold should be avoided as such is so apt to precipitate the pneumonia. The patient should be isolated from others at first. As to exactly how long this quarantine should be kept up there is much difference of opinion, but probably no case is contagious more than six weeks after the onset and many would put the infectious stage as only half of this time, even though the “whoop” continues, as it is very apt to do for much longer. There is a common saying that a child does not lose the whoop until the next spring, which may be many months away. This is not true, but still the whoop may tend to recur for a long time. He should be warmly clothed. Prophylactic vaccination has been tried with some success and it may be well to use it when an epidemic is raging. An ordinary dose is 100 million once weekly for 3 doses.

Diet.—This should be simple and nourishing. Very often a meal will precipitate a paroxysm and the meal may be vomited, and in some cases great emaciation thus results. But if after the attack of vomiting the meal be immediately repeated very often it will this time be kept down, or the nurse may watch the patient and only feed immediately after a paroxysm.

Specific Treatment.—Vaccines are said to be of some value here but they certainly have not given satisfaction in all hands. A most carefully controlled series of cases studied in New York by the Health Department showed no good results from vaccine therapy. If used, an average dose for a child of five is one billion, this being given every second day in double doses until four doses have been given. Some combine

with it strains of the organisms commonly encountered in pulmonary diseases in infants.

The blood serum of convalescents has been injected and seems to have some prophylactic but no curative influence.¹

Quinine has been much used and may possibly have some slightly specific action on the infection. A child of five years may have three grains thrice daily. The Euquinine is the best form to use in every case where we wish to employ this drug in childhood on account of its tastelessness.

Symptomatic Treatment.—A great many drugs have been recommended here which tells the tale of how unsatisfactory they all are. Every physician has his favourites. I have found a mixture of belladonna and strontium bromide to be of value in lessening the frequency and severity of the paroxysms, but many rely on phenazone (one grain at a dose for each year of the child's age), given every 4 to 6 hours.

A useful and pleasant prescription is the following:—

R	Strontii Bromidi.	gr. lx
	Tinctur. Belladonnae	
	Extract. Thymi.	āā 5iss.
	Syrup. Simplicis	ad ʒiij
	Misce.	

Sig.—A teaspoonful thrice daily.

For a child of two years.

Claude Ker speaks highly of the value of adrenalin, given by the mouth in doses of 1 to 5 mins. of the 1/1000 solution every four hours.

Children stand belladonna very well. Bromoform is used by many in doses of 1 minim for each year of age up to five, every 4 hours, and it certainly eases the paroxysms. Inhalations are of some value, such as the *tinct. benzoin. co.* from hot water, or menthol, eucalyptol, etc.

When vomiting is severe a well-fitting abdominal belt often gives comfort.

¹*Brit. Med. Journal*, April 14th, 1923, p. 651.

CHAPTER IX.

DISEASES OF THE RESPIRATORY SYSTEM.

BRONCHITIS, ACUTE AND CHRONIC. BRONCHIECTASIS.

FOETID BRONCHITIS. PLASTIC BRONCHITIS.

ACUTE BRONCHITIS.

Acute catarrh of the respiratory mucous membrane may arise from a variety of causes, but is usually due to an infection. But irritants may cause it, such as the fumes of nitric acid, and also chlorine and other gases, as was lately seen during the war.

Infections may be local, as in that due to the *micrococcus catarrhalis*, or general, as in measles and influenza.

In respiratory catarrh there are three distinct stages, which may be well and personally studied when one has a common cold. First, there is the stage of engorgement of the mucous membrane, with consequent obstruction of the air passages due to the swelling, and yet there is no secretion. Next, the stage of secretion, this secretion being at first scanty and watery and later mucopurulent and abundant; and lastly there is the stage of drying up and return to the normal.

The symptoms of respiratory catarrh are fever, some dyspnoea, cough and expectoration, with more or less pain, or rather rawness, over the front of the chest. The severity of the symptoms depends almost entirely upon how far down the respiratory tree the inflammation extends. Thus, while a common coryza is a trifling ailment, a laryngitis is more serious, a bronchitis of the larger tubes still more so, while a capillary catarrh is frequently fatal.

Diagnosis.—A diagnosis of bronchitis is not a sufficient one for the therapist. He must endeavour to ascertain how far down the tubes the trouble extends. Also, whether it is a local condition or only part of a general one, such as measles, influenza, typhoid or whooping cough. If an infection, then what is the offending organism? Or again, does the acute attack

merely complicate some other predisposing condition, such as mitral stenosis, congenital heart disease, or a toxæmia like gout or uræmia? Or is it only an exacerbation of a chronic catarrh? All these points bear greatly on the prognosis and treatment.

Environment.—The patient should be in bed, unless indeed the catarrh be limited to the upper air passages, but even then he will recover more quickly if he thus takes care of himself.

The air of the room must be fresh, but not cold. A temperature of about 65° Fahr. will suit best in most cases. Cold air acts as an irritant to the inflamed mucous membrane.

If the case be a very acute one, it is well to moisten the atmosphere with steam. This is most easily done by putting a tent over the bed or cot and then directing the spout of a kettle, prolonged with a brown paper cone, towards the foot of the bed. It is important not to direct the steam at the patient's face, as steam, if too hot, is very irritating. The air can often be made still more soothing by some medication. (See page 148).

The patient should not be allowed to stay in any one position for very long, but should be shifted from side to side, to lessen the risks of hypostatic engorgement and oedema of the bases of the lungs, and also to assist in the getting rid of any accumulated expectoration. In severe cases he may require to be propped up in bed. He should be cautioned against talking, as this tires the respiratory apparatus and also tends to bring on the cough.

Diet.—The patient has some fever and hence the food should be light and easily digestible. Fluids, especially hot ones, all act as expectorants and hence the free taking of such drinks as warm barley water, oatmeal water and thin gruel should be encouraged, especially in the first or dry stage of the disease. In severe and long-continued cases alcoholic stimulants may be required, chiefly in patients who have been accustomed to the use of them.

Specific Treatment.—Acute bronchitis is not usually due to any one infection and as a rule is not amenable to any vaccine therapy. Within the last few years this has been freely tried

but has not given the good results that so often follow its use in chronic conditions.

Camphor and quinine often seem to have some controlling influence upon the slighter cases and may be tried. Many people think that they can sometimes cut short a cold in the head or even a slight bronchial catarrh by the early and free use of camphor in doses of two to five grains by the mouth.

A useful prescription in feverish colds is the following:—

R	Quininae Sulphat.	gr. i.
	Phenacetini	gr. ii.
	Salicini	gr. iij.

Fiat capsula.

Sig.—One every four hours.

Symptomatic Treatment.—In early and slight cases a hot bath, a hot drink, a purge and perhaps 10 grains of Dover's powder is all that is required.

By symptomatic treatment we hurry on the stages of the catarrh and thus lessen the discomfort; in bad cases such treatment may make the difference between death and recovery.

The fever may be treated with some mild diaphoretic mixture, to which, if necessary, expectorant drugs may be added. The bowels should be freely opened at first, best with a mercurial, such as three or four grains of the blue pill combined with an equal quantity of the colocynth and hyoscyamus pill, and followed by a saline next morning.

The pain and discomfort in the chest is well relieved by hot applications, such as a mustard poultice applied for twenty minutes, or a mustard leaf put over the manubrium sterni and left on for a similar period. In less acute cases and also in bad ones later on a stimulating liniment rubbed into the whole chest night and morning often gives a good deal of relief. Any stimulating one will do and a favourite is the *linimentum terebinthinae*, which may be made more active by combining with it the mild tincture of iodine in the proportion of one drachm to the ounce.

Cough is usually the predominating symptom in acute

bronchitis and the proper treatment of it is a very important matter. It is well to remember that there are both useful and useless coughs, and before the practitioner proceeds to try and stop the distress he should ascertain to which of these classes the cough belongs. If it be due to irritation about the pharynx often the best treatment is the frequent sipping of some demulcent, such as barley water. Barley water is best made by simmering a tablespoonful of washed pearl barley in a quart of water for two hours. Strain through muslin. Such a demulcent is specially useful when the patient is constantly awakened with a dry tickling cough. He can have a glass of it at the bedside and sip frequently as required.

In the early dry stage of the catarrh, when the cough is due to the congested state of the mucous membrane, it is best treated by hurrying on the secretion by the use of the so-called sedative expectorants.

Expectorants are drugs which modify bronchial secretion. Their use is largely empirical and the frequency of their employment has undergone great fluctuations. At one time they were used wherever a cough existed, and then a wave of scepticism set in and they were almost universally condemned. I think that now most practitioners of experience will agree with the late Dr. Forchheimer when he wrote that, "expectorants are often very disappointing and uncertain, but I would be very sorry to do without them." The pharmacological work on them has so far been of almost no value to the practitioner, because the pharmacologist has to deal with their effect or want of effect upon normal mucous membranes in animals, while the practitioner is concerned with abnormal mucous membranes in man. In the former case the drug is acting against and in the latter with the efforts of Nature.

Expectorants act (1) by stimulating the vagal nerve-endings in the bronchi, or (2) reflexly from the stomach. "All emetics, when given in sub-emetic doses, act as expectorants" (A. J. Clark¹).

There are three classes of expectorants:—(1) The Sedative, Depressing or Nauseating expectorants. These are usually also diaphoretic; (2) The Stimulating expectorants, which

¹*Applied Pharmacology*, 1923.

tend to increase the flow of secretion, but are also stimulating to the circulation; (3) The Aromatic expectorants, which are antiseptic in action.

It is upon the sedative expectorants that we chiefly rely in the treatment of the early stage of acute bronchial catarrh. The ones most used are, Ipecacuanha, Antimony, and the Alkalies. Iodide of Potassium occupies an intermediate position between the depressing and the stimulating group and is much used when we wish to produce a watery secretion in the less acute cases. The dose of it here is a small one,—3 to 5 grains thrice daily, and it is a peculiar fact that this dose will produce more bronchial flow than will a larger one.

Ipecacuanha.—The action of ipecacuanha is mainly due to its chief alkaloid, *emetin*. This depresses the circulation and is mildly diaphoretic. It is excreted by various mucous membranes and causes a free secretion from the bronchial one, especially when this is in a state of inflammation. It also tends to relax spasm of the bronchial musculature. In larger doses it is an emetic, and, as will be referred to later, it has a specific effect upon the amoeba of dysentery.

The preparation most used as an expectorant is the *Vinum*, in doses of 5-15 minims as often as every four hours. The *Pulvis Ipecacuanhae Compositus* (Dover's Powder) contains one grain each of ipecacuanha and opium in ten grains and is much used in the early stages of catarrh in single doses of 5-15 grains.

Antimony acts as an expectorant in the same way as the ipecacuanha, but is more depressing upon the circulation, and tends to weaken the heart, partly through its neuro-muscular tissues and partly reflexly through the stomach. Its use should be reserved for sthenic patients. The *vinum antimoniale* is the preparation most commonly employed. It contains $\frac{1}{4}$ grain of tartar emetic (*Antimonium Tartaratum*) to the drachm and the dose is 10-30 minims. It is occasionally used as an emetic in doses of 2-4 drachms.

Alkalies.—All the medicinal alkalies act as sedative expectorants, increasing the bronchial secretion during catarrh. The Potassium Acetate and Citrate and the Sodium Bicarbonate are the ones most employed, all in doses of 10-30 grains.

Inhalations.—Various soothing inhalations are much used in acute catarrh. One of the commonest is the compound tincture of benzoin of which a small teaspoonful is added to the water in the steam kettle. Where steam is not used a useful way of employing this medication is to add it to some hot water in a jug and inhale from this. The water should not be too hot. A good temperature is obtained by mixing equal parts of boiling water and tap water. The *tinctura benzoini co.* owes its soothing properties chiefly to the contained tincture of tolu and better results may be obtained by using this latter alone instead of the compound tincture, as this also contains aloes which is irritating. In slight cases much comfort can be obtained by inhaling the following from a handkerchief:—

R Menthol
 Eucalyptol
 Terebeni
 Chloroform. āā 3j M.

Sig.—Inhale from a handkerchief.

Thus, to summarize, in the acute stage of bronchial catarrh the patient should be in bed; should have hot or stimulating applications to the chest; should breathe warm, moist and perhaps medicated air. Such a mixture as the following will be useful:—

R Vin. Ipecac.
 Potass. Citrat.
 Syrup. Tolu. āā 3iij.
 Aq. Chloroform. ad ʒvi.
 Misce.

Sig.—A dessert spoonful every four hours.

If the patient be strong then antimony may with advantage take the place of the ipecacuanha.

In acute suffocative cases atropine, in full doses, is of use and probably acts chiefly by relaxing the bronchial muscles. Its effect in improving the respiration in bad cases of “gassing” was often very evident.

As soon as the secretion is well established the patient feels better and all expectorants should be stopped.

In the last stage, if the drying up of the secretion is delayed, belladonna will occasionally assist, although this is usually a matter of experiment in individual cases, as it may produce such a tightness in the chest that the patient is better without it. Certain of the mineral acids are believed to assist in this process, and most hospitals have such a mixture as the following in their pharmacopoeias:—

R	Acid. Nitro-hydrochloric.	Dil	min. x.
	Glycerini		min. xv.
	Infus. Quass.		ad ʒss.
	Misce.		

Sig.—To be taken before meals thrice daily.

But the chief treatment in this third stage is to endeavour to improve the general health of the patient by the use of tonics as seem suitable to the individual case, and especially good feeding and lots of fresh air and sunshine. Cod liver oil is usually valuable here and iron may be combined with it if there be any anaemia.

When the catarrh extends to the smaller branches of the bronchial tree the condition is serious. Here usually pneumonia complicates the case and the treatment will be considered under that heading. Every case of acute bronchitis, where the temperature is above 104° and where the breathing is over 30, has probably more or less pneumonia as well. These serious cases of combined capillary bronchitis and lobular pneumonia are specially prone to occur in young childhood and in old age.

CHRONIC BRONCHITIS.

Chronic bronchitis generally follows upon repeated attacks of acute catarrh, each of these taking longer to clear up until at last the condition becomes more or less persistent. In some instances, however, such as in heart disease, inhalation of dusts, alcoholism, gout and chronic nephritis, no such acute onset is evident.

In all cases of chronic bronchial catarrh the condition is apt to be complicated by intercurrent acute attacks and each of these tends to leave the chronic condition a little worse.

Usually infection of the bronchial mucous membrane is present and in some instances this is due to a single kind of organism, or if, as is more commonly the case, a mixed infection be present then some one type of organism predominates. Such cases are often very amenable to vaccine therapy. The mucous membrane is thickened or atropic, is congested and the normal ciliated epithelium is more or less replaced by stratified and transitional cells. There may be irregular dilations of the bronchial tubes and usually there is considerable emphysema of the lung tissue. As a rule, there is no fever, except during the acute exacerbations. Cough is the chief symptom, and there is always more or less dyspnoea, especially upon any exertion, this being largely due to the accompanying emphysema. The sputum varies, being sometimes profuse and muco-purulent and in other cases scanty or absent. In some instances the sputum may be foetid.

Diagnosis.—It is always easy to recognize that bronchitis is present, but one must go much deeper than this into the case and try and find the underlying condition. There may be some removable cause, such as a dusty occupation, a gouty tendency, alcoholism, &c.

Environment.—Chronic bronchitics do not as a rule require to be kept in bed, although in bad cases, where the dyspnoea is great, this may be the best thing for them. They must be well protected from chills, as nothing is so apt to induce an exacerbation, and each of such attacks leaves the patient just a little further down the hill.

As a rule, cases of chronic bronchitis are better in the summer than in winter and hence, where their financial condition renders it possible, it is often wise for them to winter in some southern climate. Any place which will permit of their being the greatest number of hours possible in the open air and in the sunshine will do. As a rule, those cases in which the sputum is profuse are best in a dry climate, such as is found in the inland parts of Southern California, Colorado, Texas, Mexico, Egypt, and Nice; while those in which the secretion is scanty will be easier in a more humid atmosphere and may with advantage go to Florida, Nassau, the West Indies or Bermuda, or in Europe, Rome, Mentone or Torquay.

There seems to be no special virtue in the different waters of the much advertised watering places, but the situation, the presence of near forests, the absence of dust and especially the absence of business and other worries all help to make such resorts of value.

But most people cannot go away for the winter, and some of these, especially aged folk, may find it best simply to stay indoors all winter. In all cases, crowded and overheated rooms should be avoided as they are sure to make these patients worse.

If a chronic bronchitic must go out on a cold day, he should wear a respirator or a muffler so as to insure his breathing through the nose. He should be warned against talking in the cold, raw air.

Warm clothing is necessary, but if the house be warm then often a double set of thin summer underclothing is the most comfortable. This is less oppressive than heavy underwear and the air space between the layers is an excellent non-conductor. When they go out the extra protection necessary can always be furnished by a thick overcoat.

Chronic bronchitics should avoid as far as possible people who are suffering from colds in the head, as they are so apt to become infected, with much damage to their weakened tissues.

Exercises are of value and should be systematically practised. Most "systems" of exercise are so complicated that the learner, after a short time of enthusiasm, gives them up. One of the best exercises for these cases is the taking of long slow breaths, laying special emphasis upon expiration. If the patient at the same time place his hands on the sides of the chest and during the last part of expiration press here, he will increase the scope of the expiratory act. At the very end he should bend forward, as this presses the diaphragm upwards. Such exercises may, with advantage, be performed night and morning perhaps for a dozen breaths.

Diet.—Usually cases of chronic bronchitis are below par in weight and strength, and should be fed up, especially with fatty foods, such as butter and cream. If there be any gouty

or uraemic tendency, however, these must be met by appropriate dietary.

Occasionally we meet with chronic bronchitis in the obese, and these cases, which are usually very persistent, should be put upon a course of lean meat, a saline purge every morning, and water freely between meals. Such a dietary or course will often work great improvement here.

Cod liver oil may be looked upon rather as a food than as a drug. It is of great value in most cases of chronic bronchitis and may often be taken with advantage throughout the winter months. As a rule, it is not necessary, nor is it well borne, in summer. Probably the chief value of cod liver oil is owing to the fact that it is a fluid containing fat in a very fine state of division, and, if this be so, then certain proprietary preparations of it in which the fat is missing are not so efficacious as the whole oil. The oil contains about 250 times as much vitamins as does butter. If the oil "repeats" it can often be better taken between courses rather than after a meal. When it disagrees with the stomach during the day it can frequently be taken at bedtime without any discomfort. As a rule, patients who really need cod liver oil have little objection to it and one often sees ill-nourished children fairly crave for it.

Specific Therapy.—The vaccine therapy of chronic bronchitis is still upon its trial, but where the infection is a single one, or at least one type of such predominates, it promises well and one sometimes sees very long-standing cases greatly benefitted by it. An autogenous vaccine should be employed. Patients when under the influence of such a vaccine also seem less apt to acute exacerbations, which is a point of great importance.

Symptomatic Treatment.—We can often do much to make the patient more comfortable and to lessen the progress of his trouble, although the success cannot be as complete as in the acute forms. In slight cases of chronic respiratory catarrh the patient may, indeed, outlive most of his fellows, and it was of such cases that Oliver Wendell Holmes was thinking when he humorously wrote that the disease tended to promote longevity.

In the common type of the condition, where the cough is free and easily brings up the expectoration, no expectorants are required and all that we need do is to regulate the patient's way of living and his surroundings, and to raise his general health in every way possible by the use of good food, fresh air and any indicated tonics.

Often the cough in such cases is almost confined to the mornings, when the patient on waking will cough a great deal before he manages to expel the secretion which has accumulated in his tubes during sleep. In such cases a hot drink will usually much help, especially if to it be added an alkaline expectorant, such as the following:—

R	Sod. Bicarbonatis	gr. xx
	Sod. Chlorid.	gr. v
	Spirit. Chloroformi	min. x
	Aquam Anisi	ad ʒj Misce.

Sig.—To be taken in a glass of hot water on first waking.

In those cases where the sputum is scanty and hard to bring up, much relief can be given by the use of the Stimulating Expectorants. The ones most commonly used here are squills, carbonate of ammonia, ammonium chloride and iodide of potash.

Squills. *Scilla*.—This drug has a very similar action as regards the heart to digitalis, but in addition to this causes secretion from the bronchial mucous membrane and thus acts as an expectorant. In the stomach it tends to irritate and in large doses it will produce nausea and even vomiting.

The preparations of *Scilla* are the solid drug (dose 1-3 grains), the tincture (dose 5-15 mins.), the *Oxymel Scillae* (dose ½-1 drachm) and the syrup of squills in the same dose as the oxymel. Both of the last named preparations contain acetic acid and are hence incompatible with alkalis.

Ammonium Carbonate is a general stimulant and also stimulates the bronchial mucous membrane and also the respiratory centre. In large doses it is an efficient emetic. Inhaled as smelling salts, it stimulates the respiratory tract directly and also reflexly. The dose is 3 to 10 grains as an expectorant and half a drachm as an emetic.

The *Spiritus Ammoniae Aromaticus* is greatly used as a general stimulant in doses of 20 to 40 minims, well diluted with water.

Ammonium Chloride acts in much the same way as does the carbonate upon the respiratory tract and is given in doses of from 5 to 20 grains. It also is believed to increase the flow of bile from the bile passages and is much used in tropical countries in cases of "sluggish" and congested liver. Iodides have already been mentioned. They do not act upon the circulation, but directly upon the bronchial mucous membrane, producing a flow of watery secretion.

Such a prescription as the following is useful in chronic cases characterized by a scanty secretion:—

R	Ammon. Carbon.	gr.	v.
	Tinct. Scillae	min.	x.
	Syrup. Pruni Virg.	min.	xx.
	Infus. Senegae	ad	3jss M.

Sig.—To be taken in water thrice daily after meals.

In many cases, where the secretion is scanty and the cough is very trying and ineffective, the old stock mixture, as follows, is useful:—

R	Tinct. Camphor. Co.
	Oxymel. Scillae
	Syrup. Tol. āā mins, xx. M.

Sig.—To be taken occasionally in water.

Opium, however, or any of its preparations, should be avoided as much as possible in cases of chronic bronchitis, both from the danger of habit formation, and also because it dulls the respiratory reflex and hence, where the secretion is excessive, this tends to accumulate instead of being got rid of by coughing. It also weakens the respiratory centre. Many deaths are no doubt annually precipitated by the unwise use of such preparations, and the Governments of the United States and Canada are now becoming very strict in regard to the sale of proprietary medicines containing opium or any of its alkaloids. Such powerful drugs should certainly only be used under medical supervision.

When the secretion is excessive belladonna may be cau-

tiously used and sometimes is effectual, although at others it gives the patient a sensation of tightness in the chest and hence must be discontinued. The mineral acids are more generally useful and seem to have some obscure influence in helping to dry up such a bronchorrhoea. The mixture already mentioned under acute catarrh may be used here. It consists of nitro-muriatic acid in infusion of quassia.

BRONCHIETASIS AND FOETID BRONCHITIS.

In these very distressing cases, besides doing everything possible to raise the general health (the importance of which cannot be over-estimated), we should endeavour to lessen the foetor of the secretion and try to disinfect the respiratory tract. The *Aromatic Expectorants* are the drugs chiefly used here. When taken internally these are excreted by the bronchial mucous membrane and thus act locally. Many of them are also administered by inhalation. All aromatic vegetable substances act more or less in this way, but the ones most used in practice are the following:—

Creosote.—This is a mixture of guaiacol, creosol and other phenols and is got by distillation from wood tar. It is greatly used, both internally, in doses of 1 to 5 minims and as an inhalant and then it is well to combine it with an equal part of spirit of chloroform. Perhaps the most efficient aromatic expectorant is the Guaiacol Carbonate. It may be given in doses of 10 grains as often as every four hours, and its creosote-like odour soon appears in the breath.

Turpentine is often given internally in doses of 2 to 10 minims, or it may be inhaled from the surface of hot water. It is very commonly used as a liniment, when some of its good effect is probably due to its being inhaled by the patient.

Terebene is pleasant to take. It is given in doses of 5 to 15 minims, and is also very commonly used as an inhalant.

The general health is often wonderfully maintained in bronchiectasis, especially in children, and the odour is often more distressing to others than to the patient himself. No medicine will cure the condition, but the odour may be lessened by such means and the patient's general condition much improved. If the internal use of such aromatics be not

sufficient, in addition to this method of administration, inhalation may be employed, either as already mentioned or more thoroughly in the form of the *Creosote Vapor Bath*. Here the patient is placed in a small chamber, the eyes being protected with closely-fitting goggles and the nostrils plugged with cotton wool, and creosote is vaporized by being heated over a spirit lamp. Strong coughing is induced, often with much distress at first, but the cough brings up a large quantity of expectoration and soon the patient feels the benefit of the treatment. He is usually given about fifteen minutes in the bath daily at first and then the period is gradually increased to perhaps half an hour. Under this treatment the patient may improve greatly and put on weight. Intratracheal injection of menthol and olive oil (8-12%) has been advocated in bronchiectasis. It has been shown experimentally on animals that the oil finds its way into the finest bronchioles and is there absorbed with its contained medication. Colin Campbell, who much advocated this method, describes his technique as follows:—"The tube should be rapidly passed into the larynx and should fit the curve of the base of the tongue and lie close against it, thus fixing the epiglottis and preventing spasm. The squirt should be delivered like lightning—either with inspiration or during a slightly prolonged interval following expiration. If the operation be properly performed the patient should not perceive the taste of the fluid injected." Mr. Campbell later on advised that the olive oil be replaced by glycerine, and that two per cent. of guaiacol be added in addition to the menthol. The bulk of the injection should be about 100 minims and this should be repeated twice or thrice at each sitting.

Postural treatment is important, most patients finding that in certain positions they can best get rid of the secretion.

If all these medicinal methods fail to give relief in a case of bronchiectasis, then something more radical must be tried. The least severe method is the induction of artificial pneumothorax on the affected side. In one patient there was high hectic fever with profuse sweating and great loss of weight. He was bringing up about 300 c.c. of very foul sputum and his

condition seemed desperate. I collapsed the lung, in which we could see with the screen a large bronchiectatic cavity. The operation was difficult as there were adhesions, but after several sittings the lung, as shown by the screen, was all collapsed except for a broad band that contained the cavity. For a day or two at first the sputum was increased in amount but after that rapidly lessened and at the same time the fever almost disappeared, also the sweating at night, and the patient was soon convalescent and rapidly put on weight. A year later he was practically well and then I lost track of him.

Purely surgical treatment has often been tried in this condition and, although some successful cases have been reported, on the whole the results are discouraging. When only a single dilatation exists then incision and drainage may be successful, but these are, as a rule, the least urgent cases, and where the dilatation is multiple the difficulties are greatly increased. For full details as to the surgical treatment of bronchiectasis the reader is referred to any of the reference handbooks.

PLASTIC BRONCHITIS (Fibrinous Bronchitis).

This somewhat rare condition may occur as a secondary process in some diseases of the bronchi or lungs or may complicate all manner of general infections. In it casts are formed in the bronchi, consisting of fibrin and mucin, and these may be expectorated after great effort, and form, when they are floated out in water, complete moulds of the bronchi from which they have come. The treatment consists in attempting to free the casts, when they will be expelled by the act of coughing. Potassium iodide and ammonium chloride are the most valuable drugs for this purpose. A warm spray of lime water will help in loosening the casts, mucus being soluble in it. Emetics may assist, both by the expulsive action that occurs in the bronchi in the act of vomiting and also by the free bronchial secretion that precedes this act. One case is recalled where a patient seemed *in articulo mortis* and when apparently in the act of dying, vomited and brought up a complete cast of much of the respiratory tract and recovered. A year later she died in an attack.

Complete cure sometimes occurs, but, as a rule, as in this instance, the condition tends to recur.

CHAPTER X.

DISEASES OF THE RESPIRATORY SYSTEM.

PNEUMONIA. PULMONARY OEDEMA. GANGRENE AND ABSCESS OF THE LUNG.

PNEUMONIA.

It has been estimated that about one in every ten deaths is eventually due to pneumonia. In many instances this is merely the final cause of death in the form of a terminal infection.

The mortality in pneumonia varies enormously, being much heavier in some types of infection than in others and also differing in different invasions of the same type. The resistance of the individual is here also important so that while a frank lobar pneumonia in a previously healthy young adult is not a very fatal thing, the same disease in a decrepit old man is very deadly. Pneumonia is the commonest cause of death in influenza, as also in measles and whooping cough.

The disease occurs in two main forms: (1) lobar pneumonia, which is generally due to the *pneumococcus*, and (2) broncho-pneumonia, which may be the result of many different infections and which has several different varieties depending on the nature of the invading organisms. In influenza the *streptococcus haemolyticus* is usually responsible for the condition.

In frank pneumonic infection the body usually develops an immunity in a few days and the attack terminates by crisis, but in the other infections the degree and speed of development of immunity are much less definite and when the disease terminates favourably it generally does so by lysis.

Pneumonia is usually only a local pulmonary manifestation of a general infection as is shown by the fact that the invading organism can so often be recovered from the blood and also because it often involves other systems besides the respiratory one.

The treatment of pneumonia is on the whole unsatisfactory and it has been said sarcastically that we have made no advances in it since the days of Hippocrates, but with this pessimistic view it is hard to agree altogether. Certainly we can do much to help the patient to weather the storm. At the least we must endeavour to avoid extremes so as to do no harm.

Diagnosis.—Beyond merely recognizing the presence of inflammation of the lungs, it is necessary to make out the form of the pneumonia, and the special infection to which it is due. Is it a complication of some other disease, or, on the other hand, is it complicated by any condition? What is the resisting power of the patient? All these questions must be asked and answered before we commence the treatment of pneumonia, for we do not treat the disease, but the patient that is suffering from it.

Environment.—The patient, of course, is in bed, and the bed clothes should be light. A Gatch frame is often a great comfort, especially when the breathing is embarrassed. Often a pneumonia jacket is grateful, as most experienced nurses will testify.

Skilled nursing is very necessary here, and the nurse must husband the patient's strength in every possible way.

He requires lots of fresh air. There are few cases that show so much benefit from fresh and cold air as do those of lobar pneumonia. These patients do well in the verandah even in the coldest days in winter, and when once they have got used to the change, which is in a few hours, they hate to be brought into the heated wards for any purpose.

In cases where there is an accompanying bronchitis (chiefly those of the broncho-pneumonic type), one must be more careful about exposing them to rigorous weather conditions, as the inflamed bronchi are irritated by cold air, and the cough is thus apt to be made worse.

Diet.—There is usually much fever, and this suggests a limitation of the diet, but otherwise this should be as ample as possible. As a rule, the chief part of it may be milk, but many light things may be added with benefit, such as raw or lightly boiled or poached eggs, soups, jellies, junket, ice cream, etc. Carbohydrates as a rule are not well borne and tend to

produce tympanites. There is generally much thirst and it is well for the patient to drink freely of any watery drink such as lemonade or the Imperial drink. As a rule, no alcohol is required, but in special cases it may be necessary, such as in those patients who towards the crisis show much toxæmia, with a dry coated tongue, and also in most alcoholics. It is a mistake to try and correct the alcoholic habit as long as these people are in the throes of pneumonia. Later on no such objections hold and it can be pointed out to them how badly alcoholics stand the disease.

Specific Treatment.—When pneumonia tends to be epidemic, the prophylactic use of vaccines appears to be of some value. A good example of this is given by F. S. Lister.¹ In certain native mining-camps 3 subcutaneous inoculations of 1 c.c. of vaccine, having a total content of 7,000 millions of mixed *pneumococci* per c.c. rendered the population entirely immune to pneumonia for an observed period of nine months, while the epidemic remained prevalent in the mines where this practice was omitted. Most workers have found that a definite immune response occurs after vaccination with types I and II, but not with III. The incidence of type IV is also less in those vaccinated as above, which points to some non-specific protection from the vaccine. *Pneumococci* have now been shown to be of several different strains which have been named types I, II, III, & IV. The first three of these are quite definite, but type IV means all those which do not come in the first three and the *Lancet*² well suggests that type IV should rather be called “group IV” as it is the scrap heap of all varieties that do not come under types I, II, & III.

Vaccine treatment of pneumonia has been much tried, some believe with good effect, but this is by no means admitted by all. When it is used the dose is commonly 50 millions the first day, and 100 millions the next and subsequent days until the crisis or lysis occurs. The toxin of the *pneumococcus* is an endotoxin, and vaccines of this class are usually not very satisfactory. Empyema seems, however, to be less frequent in cases so treated than in others.

¹Pub. of the South African Inst. of Med. Research, No. 10.

²*Lancet*, Sep. 16th, 1922, p. 623.

Within the last two or three years a serum-free solution of pneumococcic antibodies has been extensively tried. The solution is prepared from types I, II, & III, and is given intravenously in doses of 25-100 c.c. A severe reaction, with high fever, usually follows within an hour and the temperature drops and may stay down or rise again and require further dosage. Type IV cases seem to do as well as the others which suggests that the action is non-specific. A lessening in the mortality of some 7 per cent. has been reported by Conner and by Cecil and Larsen¹, but the reaction may be severe and even fatal and the method is still on its trial.

Serum Therapy. The results of serum therapy in type I are quite good, but in the other types benefit is not yet proved. The serum retards the growth and metabolic activities of the corresponding type of *pneumococci* and causes their agglutination.

The method of administration is to give the patient $\frac{1}{2}$ mil of serum hypodermically to test the sensitiveness and to desensitize if possible. Then, if the type is I, 80 mils of the corresponding serum is given intravenously, and this is repeated every twelve hours until the temperature and pulse fall. A more or less severe reaction, with rapid pulse, high temperature and a chill, may follow the injection. These symptoms are not dangerous and may be lessened by the hypodermic use of 1/100 gr. of atropine. Such treatment has reduced the case mortality from about 25% to 7.5% in some series. A. W. Gray² gives the results of a careful comparative trial of Kyes's anti-pneumococcic serum at Camp Grant. It appeared to reduce the death-rate in all pneumonias from 53.6% (certainly a very high rate) to 16.7%. In typical lobar pneumonia, the death rate obtained here was 7.7%.

In pneumonia due to the *streptococcus haemolyticus* anti-streptococcic serum should be freely used, and appears to be of some, though not striking, value.

In influenzal pneumonia non-specific protein therapy has been used with some success.

In the pneumonic complications of influenza the blood-

¹Trans. Ass. of Amer. Physicians, 1922.

²Amer. Jour. of Med. Sc., June, 1920.

serum from patients convalescing from the same condition has been used as a therapeutic agent. Some have reported favourably on it, but the results are not very convincing.

Quinine, in large doses, seems to have some specific effect here. It has been shown to increase the leucocytosis, and to raise the opsonic index, and may act in this way rather than as a direct bactericide. Ten grains thrice daily by the mouth has certainly some controlling influence on the height of the fever, but much larger doses than this have been used. Thus it has been recommended to give 20 grs. of the double salt of quinine and urea hydrochloride intramuscularly every four hours. I have tried these enormous doses in a few cases, and am not convinced of their great value or their freedom from risk.

Symptomatic Treatment.—The average case of pneumonia, if kept in bed in the fresh air, well fed, and carefully nursed, will probably come through the siege successfully, without any further treatment. But there are certain symptoms that may require attention if he is to reach the haven of the crisis or lysis. By watching for bad symptoms and promptly treating them the physician can greatly lessen the sufferings of his patient, and may no doubt often prevent a shipwreck which might otherwise occur.

Hyperpyrexia. A certain amount of fever, like a moderately high leucocyte count, is rather a good sign than otherwise as it shows a good reaction on the part of the patient, with the probable quick production of the antibodies which can alone bring about the immunity that will save him. But if the temperature gets too high (say above 103.5°) then it is well to control it, and this can be best done by Hydropathy. The form of hydropathy most used here is cold sponging, which can be repeated every four hours. When the high temperature persists, an ice bag to the head often gives much comfort. Quinine, as already mentioned, in 5-10 grain doses t.i.d., will also tend to control an excessive temperature.

When thoracic pain is present it is due to an accompanying pleurisy, and should be treated as already described (page 120).

The bowels should be kept carefully open, best with saline

purgatives, with perhaps a mercurial at the commencement of the attack.

The *cough* is usually not severe and as a rule requires little treatment. Expectorants are not usually required, but in broncho-pneumonia with accompanying bronchitis they are occasionally needed in order to facilitate the removal of expectoration. Small doses of Potassium Iodide are here often of value. In some of these cases the secretion may be excessive, and then Atropine is useful. Strychnine, in heroic doses, is often used with good effect as it strengthens the act of expectoration.

Insomnia may be a very distressing symptom in pneumonia and it is most important that it should not persist, as few things so quickly wear out the patient. The milder Hypnotics, such as bromides, trional or sulphonal or paraldehyde may be sufficient. If these do not act sufficiently then some chloral hydrate may be used. This drug, in small doses, is not a heart depressant. The syrup of chloral, containing ten grains in the drachm, is a very useful preparation here, and may well be combined with some bromide. Occasionally it is necessary to give morphia, and it is wonderful to see what an improvement may take place in the whole aspect of a bad case of pneumonia after he has had a few hours' sleep and rest from the use of this.

The *toxaemia* that accompanies a pneumonic infection is accountable for a great number of deaths. Especially is the prognosis bad when the temperature is low, the leucocyte count is not raised, the blood pressure falls, and the tongue is dry and furred. In such cases free purgation, diuresis and diaphoresis may be of some value. When the toxaemia seems to specially involve the circulation and the pulse becomes rapid and the blood pressure low and the heart dilates, then Venesection will often do more good than anything else. It not only relieves the right side of the heart mechanically, but also lessens the toxaemia more than any other method at our command. In sthenic cases where the patient is flushed and rather cyanosed, and the pulse is strong and bounding, the timely removal of some blood from the arm may do much good. (See Chapter XVIII.)

Circulatory failure is common here and may occur in the form of heart failure with dilatation of this organ and much cyanosis, or more commonly as a vaso-motor failure, where the blood pressure falls and the patient is pale rather than cyanosed, with a tendency, however, to coldness and blueness of the extremities.

In any of these circulatory complications it is common to use Digitalis, often in heroic doses, but its value is doubted by many, who believe that foxglove has here little of the power which it shows in conditions like auricular fibrillation. Many physicians, however, give it from the first in the hope of averting cardiac failure.

Camphor, given hypodermically in olive oil in doses of 2-5 grs., is used by many and may be of some value here. It appears to dilate the vessels and at the same time to stimulate the heart, and thus hastens and "equalizes" the circulation. Strychnine, in doses of 1/30 to 1/16 of a grain hypodermically every four hours, is also of some use. Caffeine may be used in the same way, best as the caffeine-sodium-benzoate in doses of 1-3 grs. hypodermically. In patients showing a falling blood-pressure, Pituitrin is a very valuable remedy, and by its use the blood pressure may be maintained at a safe level for long. In very urgent cases it may be given intravenously in quantities of $\frac{1}{2}$ to 1 c.c and in less urgent ones hypodermically. As mentioned later, it is of value when there is tympanites. In pneumonias complicated with oedema of the lungs (a very urgent and serious thing), Atropine, given hypodermically in doses of 1/100 of a grain, should be employed.

Cases of pneumonia showing anoxaemia, as evidenced by cyanosis, dyspnoea and rapid breathing are urgently in need of Oxygen and this should be efficiently administered to them as early as possible. (See Chapter XVII.)

In cases showing great weakness and toxæmia, Glucose has been used with good effect. A 10% solution in filtered and twice-distilled water may be given intravenously to the extent of 250 c.c. in the hour. It acts as a diuretic and is valuable also as a nutriment.

Tympanites is often a distressing symptom in toxic cases and should be treated with turpentine stupes or enemata. If

these be not effectual an enema containing two drachms of tincture of digitalis may be given or pituitrin injected intramuscularly (0.5-1 c.c.).

Treatment by "fixation abscess" has been much used lately in France in cases of severe toxic pneumonia. One mil of *oleum terebinthinae* is injected under the skin in the lumbar region or over the front of the thigh, and in a few days an aseptic abscess develops and is poulticed and opened. A leucocytosis occurs and apparently in this or in some other way an improvement in the general condition occurs. Sometimes no abscess is set up and in such cases the prognosis is specially bad. A. T. Todd¹ speaks highly of the method.

When in lobar pneumonia the patient reaches his crisis, which is usually about the eighth day, he is generally out of danger. But even now an empyema may occur. This should always be suspected when the temperature does not fall satisfactorily, or having done so, tends to rise again, especially when such a rise is accompanied by a leucocytosis. When in any doubt it is well to use the exploring needle freely as pus in the pleura often gives the signs of consolidation rather than of fluid.

Even if no pus is found it has been observed by many that the needling of a persistent pneumonia is followed by much improvement in the condition and some have even advocated it as a treatment here.

The pneumonic patient may be allowed out of bed after his temperature has been normal for a week. He usually convalesces rapidly now, but tonics containing iron and strychnine are generally used with advantage here. A change of air and scene is now often advisable and helps to completely restore the patient to health.

ACUTE PULMONARY OEDEMA.

This serious condition may come on in the course of a pneumonia or other acute lung condition, or may occur suddenly as a complication of various infections or in such conditions as heart disease, arterio-sclerosis and chronic nephritis.

¹*Lancet*, Jan. 7th, 1922, p. 12.

The symptoms are urgent dyspnoea with an incessant cough and a copious frothy expectoration.

Treatment.—The patient should be given atropine hypodermically (1/100 of a grain or more) at once and if there be much cyanosis oxygen may be used. Dry or wet cupping over the bases of the lungs is of service. Venesection will frequently be required, especially in the cases showing a high arterial blood pressure or in those with much lividity. Occasionally morphia has seemed to save life. It should always be combined with atropine when used here.

GANGRENE OF THE LUNG.

This very serious condition may follow pneumonia, bronchiectasis or any other infective lung condition. It frequently results from the inhalation of septic material after operations about the upper air passages. But sepsis anywhere may be complicated by gangrene of the lung.

The presence of gangrene is generally made known by the occurrence of an extremely foetid sputum, along with symptoms of severe general toxæmia.

Treatment.—The patient should be as highly nourished as possible, often including the administration of large quantities of alcohol. The various aromatic expectorants and inhalants have some effect in lessening the foetor, and should be tried. (Page 146.)

Perrin¹ speaks very highly of the good action of Arsphenamine given intravenously in these distressing cases. It is specially likely to be of value when *spirilli* exist in the sputum.

When the area of gangrene appears to be localized, it may be treated surgically, and often life can only thus be saved.

ABSCESS OF THE LUNG.

Suppuration in the lung may occur from disease of the lung, from extension from a septic process in a neighbouring organ or from metastasis from an area of suppuration anywhere in the body.

¹*La Presse Medicale*, 1919.

Diagnosis.—Abscess of the lung is very hard to distinguish from interlobar empyema. Occasionally the first definite sign occurs when the patient suddenly coughs up a considerable quantity of pus. The abscess has here evacuated itself through a bronchus and the case may then terminate favourably. Such spontaneous cure is specially apt to occur when the abscess is high in the lung.

Environment.—The patient should be kept quiet in bed. He frequently finds that certain postures enable him best to cough up the pus from the abscess cavity. Fresh air is very needful and the more the patient is kept out of doors the better for him.

Diet.—The patient should be fed up in every possible way. If the appetite be poor it can often be improved by the use of bitters before meals.

Radical Treatment.—Some of these cases, as just mentioned, get well without any operative interference. Thus Wessler¹ from a study of a large series of such cases found that one-third of them naturally recovered, and that usually within two months. For this reason he concludes that any operation may profitably be postponed for several months. But where the pus is foul and there is evidence of active destruction of the lung then surgical treatment is necessary. It is the physician's duty first to try to localize the abscess cavity by every method of physical examination, including the use of the X-ray. Where the collection of pus is single there is a good chance of surgical success, but when it is multiple operation is not likely to succeed. In patients over the age of forty the mortality from operation is very high. The operation may consist in simple opening and drainage of the abscess cavity or in lobectomy. In cases of large abscess of long standing it may be necessary to do an extensive resection of ribs.

Many think that artificial pneumothorax is the best local treatment in lung abscess, and where extensive pleural adhesions do not make it impossible, it may be tried and is certainly less risky than operation. In a recent collection of cases

¹*Jour. of the Amer. Med. Ass.*, 1918.

thus treated and reported by Goldberg & Biesenthal, 75 per cent. were improved and 12 per cent. died. The pneumothorax need only be partial, as shown by H. M. Rich¹.

Symptomatic Treatment.—The various aromatic expectorants are often employed in these cases in order to lessen any foetor that may exist in the expectoration (*vide* Foetid Bronchitis). If the sputum be thick and difficult to get rid of, ammonium chloride or potassium iodide will frequently be of assistance. Opium and all its derivatives should be avoided here and the cough rather encouraged by the use of free doses of strychnine.

¹*American Journal of the Med. Sciences*, Sept., 1922.

CHAPTER XI.

DISEASES OF THE RESPIRATORY SYSTEM.

TUBERCULOSIS.

Tuberculosis is an infection which in its various forms causes one-tenth of all deaths. It kills over 150,000 people annually in the United States and nearly 10,000 in Canada.

The infection attacks nearly everybody sooner or later. Thus Naegele showed that there are some traces of the disease in 75% of people at the age of seventeen, in 90% at twenty-one, and in practically all at the age of forty. From this it is evident that the body has great resisting powers in regard to the infection;—in other words, that the tissues can in most cases defend themselves so that, although nearly always invaded, the infection is usually completely killed out or else is walled off, and thus is kept localized. All treatment is directed towards increasing this natural tendency to the production of immunity.

The respiratory system is the one in which most commonly the tubercle bacillus finds lodgement, but all the general treatment that will be presently discussed applies equally well, whatever system be invaded.

The disease occurs in the lungs in the following well-defined forms:—

- I. Miliary.
- II. Pneumonic Phthisis,—(a) Lobar.
(b) Lobular.
- III. Caseous.
- IV. Fibro-caseous.
- V. Fibroid.

Miliary Tuberculosis of the lungs is only part of a general miliary infection. It is practically always quickly fatal, and our treatment can only be symptomatic and directed towards easing the patient's suffering.

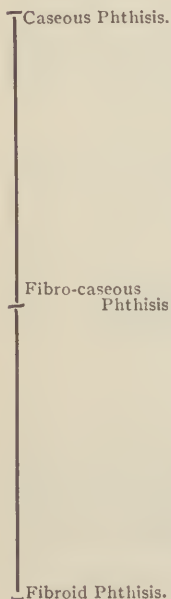
Pneumonic Phthisis is usually diagnosed as pneumonia of some type at first, and then, as the disease drags on and the temperature swings in a hectic manner, with heavy night sweats and progressive emaciation, the more serious nature of the infection becomes probable, and, finally, the finding of the tubercle bacillus in the sputum or, indeed, sometimes only a *post-mortem* examination, makes the diagnosis a certain one.

The treatment of the condition is practically that of pneumonia without the same prospects of success, although occasionally one sees a case of this kind settle down into the more chronic type of the infection. Hence the prognosis is not entirely bad and every endeavour must be made to sustain the patient's strength in the hope of this occurring.

PHTHISIS PULMONALIS.

The Caseous, the Fibro-Caseous, and the Fibroid cases of Phthisis, are all degrees of the same condition. If we make a scale (Figure II), we can put the caseous type at the top, the fibroid at the bottom, and the fibro-caseous midway. The more acute are the symptoms, the more the case approaches the caseous end of the scale, while the less acute they are the further down the scale the case can be placed. The same patient will fluctuate on the scale, and our endeavour is always to get him towards the fibroid end of it, because it is by fibrosis that Nature walls off or cicatrizes an area of infection.

Figure II.



One constantly hears it said that "consumption" is inevitably fatal unless the patients are treated upon the most modern plan of sanatorium therapy. No greater mistake was ever made, for, while it is quite admitted that such treatment greatly increases the chances of the patient's recovery, still we frequently find even advanced pulmonary lesions, with cavity-formation, in the bodies

that reach the dissecting-room, and where death has been due to some other cause. Such people generally belong to the dregs of the population and have had everything against them, and yet Nature has managed to cope with and wall off the infection, even when advanced.

Diagnosis.—The earlier the recognition and the sooner that the patient is placed in the best surroundings for fighting the infection, the better will be his chances of recovery. Hence the value of early diagnosis; and in every suspected case we should leave no stone unturned, by the use of every known method of diagnosis, to settle this important question. Having come to the conclusion that the case is one of pulmonary tuberculosis, it must also be ascertained to what type it belongs and what is the extent of the lesion and the probable acuteness of the invasion. To what part of our scale does the case belong? Also the probable resistance of the patient to infection should be investigated, and here any family tendency to the disease, which means an inheritance of a poor degree of resisting power, must be as far as possible ascertained.

In estimating the probable acuteness of a case it is well to remember that symptoms are far more important than signs. It is, indeed, the ones near the caseous end of our scale that show the most symptoms (high fever, sweating, rapid emaciation, &c.), and the fewest signs; while those at the fibroid end are the easiest to diagnose from physical examination, and yet show the fewest symptoms.

Environment.—If there be any fever, the patient is best in bed. By so placing him, the fever will tend to be lessened and his strength will be conserved.

In cases without fever the question of Exercise is an important one. Exercise tends to improve the general health and hence the resisting power of the patient, but it is found that it also very easily raises the temperature. In fact, the state of the temperature after a definite amount of exercise is a valuable test of how well the patient is. The exercise probably causes the system to be invaded by the toxins of the disease, and if used very cautiously really inoculates patients with an autogenous tuberculin. The more quiescent the lesion is, the less will the temperature tend to be raised by exertion. We

may lay down the general rule that the more gentle exercise a patient can take without undue exhaustion or dyspnoea and without any rise of the temperature to say 100°, the better it will be for him.

A hot bath will raise the body heat of a tuberculosis person more easily than it will that of a normal one, and it is just possible that this might be cautiously used as a test of acuteness instead of exercise in some cases.

The value of fresh air in all cases of tuberculosis is now pretty well understood by both the profession and the laity, and yet this understanding of what we now believe to be one of our important weapons in the struggle against this disease is of comparatively recent origin. Many people can remember how a consumptive patient was protected from almost any fresh air, so great was the dread of "chills." I have seen the windows of a room in which a consumptive was struggling for breath, not only closed but even caulked, for fear of any possible draughts. And this not only in winter but even in summer. True it is that Bodington in 1840 wrote a book on the value of fresh air and good feeding in these cases, but he was before his time and the *Lancet*, then, as now, the chief mouth-piece of the medical profession in England, condemned his views in one of the strongest condemnatory articles that has ever appeared in medical print. But truth cannot for ever be hidden and some twenty years ago, the profession awoke to the value of fresh air and now fully endorses Bodington's opinions. I would advise every one to read his epoch-making little work, which is entitled *The Treatment and Care of Pulmonary Consumption*.

In sanatoria the fresh air treatment is fully carried out and the patient lives in the open practically all his time. Usually in these institutions there are no upper sashes to the windows, so these can never be closed. The coldness of the air does not matter; in fact, these patients generally do better in winter than in summer. and that in a Canadian climate.

There is one exception to this rule of letting a consumptive live in the open air in all weathers, and that is when he has an accompanying bronchitis. During the period of this complication he will do better in a rather warm and moist atmos-

phere, as already discussed under the heading of bronchitis. In all cases he should be protected from direct draughts and should be warmly clad when it is cold, best in wool.

The good effects of direct sunshine are now recognized. The direct rays have a very deadly influence upon the tubercle *bacilli*. In treatment, the sun's rays are allowed to play directly upon the diseased areas and also generally over the whole body. Inoperable cases of tuberculosis of the spine, joints and various glands, have been cured by such treatment. Consumptives are more or less benefitted by it and the physician will do well to see that his patients are well sunburnt, not only on the face and hands, but also over most of the body, and especially the chest (*vide* Heliotherapy, page 94).

As regards Climate, less weight is now put upon this factor than formally was the case, but it is important to choose one in which the patient can be in the open air for the greatest number of hours out of the twenty-four; where the air is pure and free from dust, and where there is a maximum of sunshine. Places showing great changes of temperature in the twenty-four hours are as a rule not good. If the cough be dry and frequent, a humid climate is, as a rule, to be chosen, while if the expectoration be abundant, then a dry one is preferred. Glandular cases appear to be most benefitted by sea air and hence may be sent to seaside places, but I would advise against sea voyages, unless indeed they be short, and undertaken in order to reach some such place. On board ship people live for many hours in the twenty-four in small cabins, the portholes of which must often be kept shut, and then the air becomes stuffy and unhealthy.

The question of high Altitude often arises. Generally speaking, patients with any emphysema do not do well here, also those who have a tendency to haemoptysis, but apart from these exceptions, altitude is often of advantage and many elevated resorts, such as Davos and the Adirondacks, have a great reputation.

When a patient has much fever, or is manifestly ill, then it is better to keep him at home if possible. Do not send these sufferers on distant journeys, where they will have all

the discomforts of travel and strange surroundings, with very doubtful benefits.

Sanatorium Treatment.—If it were only possible, practically all phthisical patients would be better for spending some time at a sanatorium. The use of these institutions is largely educative, the patients here learning how to take care of themselves, and also how to act so as to lessen the likelihood of infecting others. Of course, when the home conditions of the patient are not good, it is well that he should be kept at the sanatorium until, if possible, his disease has at least become quiescent. But where the home surroundings are favourable, it is unnecessary to keep him away from them, and after he has been thoroughly educated in the care of himself and others, he will do just as well or even better at home, provided that he is within reach of skilled medical attendance.

While it is well that phthisical patients should for a time at least be treated at a sanatorium, practically it is impossible to carry this out on account of the lack of accommodation. In Canada only about 15 per cent. of the active cases can be thus accommodated and hence most patients must be cared for at home. A tuberculous mother should not suckle her infant, both because it will weaken her, and also because of the risk of infecting the child.

The patient should sleep alone and if possible be the only one in the room, except for attendants. He must avoid coughing in the direction of others, and should expectorate into a cloth which can then be burned, or into some form of cup which permits of sterilization. After a patient has vacated a room, this should be disinfected, including everything in it.

For years after a patient has practically recovered from phthisis, he should still live in the open air as much as possible and be urged to try and get some out-door employment if he can. Anything lowering his general health and especially any condition affecting the respiratory system is apt to cause a lighting up of his old infection. Intercurrent attacks of bronchial catarrh should be looked after with extra care.

Diet.—Tuberculosis people are nearly always more or less below their normal weight and it is most important that they be fed up to the fullest possible extent. A gain of weight is

one of the best signs we have that a patient is doing well, and the weekly weight-records are watched by the physician, and often by the patient too, with great keenness.

When there is fever and the patients are in bed, their diet should be light, consisting chiefly of milk and things made with milk, of raw eggs and other such light nutritious articles of diet. When they are up and about, then more solid food may be given, with milk and raw eggs as extras.

Cod liver oil comes in here more as a food than as a drug and is of much value. The plain oil, or some emulsion containing it, is better than any extract, as it is the finely-divided fat that is the chief element of value here. It is well to commence with small doses, given after or during meals, and these doses may be gradually increased until the patient is taking as much as two ounces a day. Sometimes a patient can take cod liver oil the last thing at night when it disagrees during the day.

Cod liver oil and sunlight have been recently shown to exert a very favourable influence on the calcium metabolism of the body¹, and as there is evidence that the ionic calcium in the blood is deficient in tuberculosis it may be that here we have one reason why these two factors are of such value in this infection. Cod liver oil, moreover, is very rich in vitamins.

A raw meat diet has been advocated and when one considers how immune the carnivora are to tuberculosis, it has at least some theoretical support. Some physicians go so far as to urge that horse flesh has peculiar virtue here, and I recall a patient in Paris who was eating raw horse flesh in sandwiches daily under medical instruction. Hippocrates said, "consumptives must eat dog's meat"!

Specific Treatment.—Tuberculin is of some value in afebrile cases. Older practitioners will remember with what enthusiasm this agent was introduced into practice over a quarter of a century ago. But soon, in the doses then used, it was found that many cases were made worse by it, and few were benefitted, and the method went out of use almost entirely. But a few still believed in its value and gradually evidence accumulated that if the dosage were properly regulated, the

¹*Jour. Amer. Med. Association*, Jan 21st, 1922, p. 159.

good effects were more apt to occur and bad ones were rare, and now tuberculin is largely used. The general principle is to commence with very small doses, and to gradually increase these, always stopping short of any decided reaction, such as a rise in temperature. Wright taught that the dosage could be best regulated by watching the opsonic index, but this method has been largely abandoned. The numerous preparations of tuberculin now obtainable can be placed in three groups:—(1) those composed of toxins produced by tubercle *bacilli* in artificial culture media, like Koch's old *tuberculin* (O.T.); (2) those containing the tubercle *bacilli* themselves or their endotoxins, like Koch's bacillary emulsion (B.E.), and (3) a combination of (1) and (2), like T.R.

As said, the initial dose should be small. One can commence with such doses as the following:—of O.T. 1/10,000 to 1/2,500 mg., and of T.R. and B.E. 1/10,000 to 1/5,000 mg. It can be given every three or four days and the dose doubled each time as long as there is no reaction. It should be given hypodermically. It is probably wise never to give tuberculin in any actively progressing form of the disease and the least indication of activity should be a warning to discontinue the treatment for a time. It has been conclusively shown by many observers that more cases having bacilli in the sputum lose these under the influence of tuberculin than when this is not given. As regards the results from a clinical point of view, Trudeau found that in early cases the results were as good without as with tuberculin, but that they were better in advanced cases under its influence. Regarding the ultimate results, Turban showed that of 86 patients whose sputum contained bacilli and who were given tuberculin, 52.3 per cent. were capable of work one to seven years afterwards, while of 241 such cases, who were not given the remedy, only 39.4 per cent. were so far recovered. Ritter gives about the same percentages.

As a rule, larger initial doses are given in tuberculosis of glands and other organs than in that of the lungs.

Many still doubt the real value of tuberculins, thinking that they only act by suggestion. An undoubted advantage

of their use is that they keep the patient and his physician in close touch.

Symptomatic Treatment.—The treatment of symptoms is of great importance in tuberculosis, as every symptom tends to wear out the patient and to handicap him in his struggle with the disease, not to mention that most of them give him much physical discomfort, much of which it is in our power to relieve.

Fever. Here rest is most important, and the patient should stay in bed or at least quite still, as long as the fever persists. If it runs high, sponging will give comfort and tend to lower it. Quinine, in doses of 5-10 grs. thrice daily will have a like effect.

Sweating at night, if excessive, shows a degree of toxæmia. It is weakening, although it is probably rather the toxæmia that is the cause of this, both the weakness and the sweating being due to the same cause. This symptom occurs rather infrequently when the patient is given constant fresh air, and thus, nowadays, we are much less often called upon to treat it than before the modern open-air method was in vogue. After a night-sweat the patient should be rubbed dry and have a complete change of clothing. Zinc oxide in 3-10 grain doses at bedtime seems sometimes to lessen the sweating. Or Aromatic sulphuric acid in 5-15 min. doses may be used. Atropine is occasionally given for the same purpose and will frequently lessen the moisture of the skin, but has other effects, such as drying of the mouth and the bronchial secretion, which often make its employment here objectionable. The dose should be 1/150 to 1/100 gr. hypodermically at bedtime.

The *cough* in phthisis is often a useful one and then should not be lightly interfered with. But occasionally it is hard and dry and very irritating, and should at least be lessened. Some demulcent, such as barley water, if frequently sipped, will often much help in a dry irritating cough, and should always be first tried. Inhalations of various medicaments, such as tolu, terebene, or eucalyptus, are often useful (*vide* bronchitis).

A dry cough in phthisis can often be controlled by the

patient's will, and this fact should be strongly impressed upon him as the constant repetition of the act causes much irritation and does him harm.

Codeine, as in the form of the B.P. syrup, is a pleasant preparation for checking a useless cough. Each drachm of the syrup contains $\frac{1}{4}$ gr. of the phosphate of codeine, and the dose is usually this amount. Heroin (diacetyl-morphine) is similarly used in doses of $\frac{1}{24}$ - $\frac{1}{12}$ gr. of the hydrochloride. A nice preparation for this purpose is the Brompton Mixture, which is as follows:—

R	Liq. Morphinae Hydrochloridi	ʒi
	Acidi Hydrocyanici Diluti	ʒss
	Syrupi Pruni Virginianae	ʒss
	Infusi Rosae Acidi	ad ʒiij
	M.	

Sig.—Half to one teaspoonful, without water, as often as every four hours when required.

If the cough is chiefly in the morning on first waking, and the sputum is thick and difficult to bring up, an alkaline aromatic mixture, such as that mentioned under the heading of chronic bronchitis, is very helpful. Or the patient may drink some warm milk to which has been added 15 grs. of sodium bromide. Rum and milk is an old and often useful remedy here. Creosote is much used in phthisis. It helps the cough by loosening the secretion and is also antiseptic. It should be given in small doses at first and then gradually increased. It is specially indicated, when, as sometimes happens, the sputum has an unpleasant odour. Also, any of the aromatic expectorants may be used here, preferably the guaiacol carbonate, in doses of 5-10 grs. t.i.d.

Anorexia is often present and is specially objectionable here, as it interferes with the successful feeding-up of the patient. Bitter mixtures before meals are often indicated, such as those containing quassia or calumba.

Diarrhoea must always be treated with great care, as otherwise it may be the commencement of a tuberculous involvement of the bowel. It is usually controllable in the early

stage, when there is probably only a catarrh present and as yet no ulceration. For this reason also, one should be very chary about the use of purgatives in a tuberculous patient. When diarrhoea exists, the patient should be in bed and put upon a diet of boiled milk, and given some simple astringent, such as bismuth and chalk, as will be discussed later. (*vide* Chapter XXIII.) If the flux be not thus simply controlled it may be necessary to use some opiate.

Haemoptysis. Spitting of blood is a very common occurrence in phthisis, in fact, phthisis is by far the most frequent cause of this symptom.

As a rule, the amount of blood lost is small and the danger of a fatal bleeding is slight, although in rare instances, when a large vessel is eroded, it may be quickly fatal. I have witnessed two such cases and, in both, the patients fairly drowned in their own blood.

When haemorrhage occurs, the patient should be kept absolutely quiet both in body and in mind, and the best way to obtain this quiet is by much assurance and the immediate administration of a hypodermic dose of morphia. He should not be permitted to speak at all. An ice bag over the probable site of the bleeding may have some effect, certainly a psychic one, and it is well to apply it. For some hours the patient should not be permitted to eat or to drink, although if he be thirsty, the sucking of a little ice will do no harm and will be grateful to him.

Usually this is all that is required, but if the bleeding be severe, or if it tends to continue for long, then other things must be tried. The two chief ways in which Nature checks bleeding are by the lowering of the blood-pressure, and by increasing the coagulability of the blood. Both these changes are themselves produced by a severe haemorrhage, but we have some power of hastening them. The bleeding in most cases comes from the lesser circulation, although it may possibly come in some instances from a bronchial artery or vein, both of which belong to the systemic circulation. Now, drugs which lower the systemic arterial blood-pressure as a rule tend to raise the pulmonary. Further, we cannot tell in a given case whether the bleeding is from an artery or from a vein.

All nitrites tend to lower the systemic blood pressure but to raise the pulmonary, and this is a theoretical objection to their use in haemoptysis. But many physicians believe that these do tend to stop the haemorrhage here, and clinical evidence is always of more value than theory. The drugs and other substances, such as serum, which hasten the coagulation of the blood are all used here. They are discussed elsewhere (page 49).

W. R. Grove¹ uses intramuscular injections of calcium chloride and says that it acts "like a charm." A 1 in 4 solution is made. In hard water there is a precipitate, but this is shaken up, and 4 mins. are drawn into a syringe and then boiling water drawn up afterwards to the 20 minim mark. The solution is injected deeply into the gluteal muscles. The injection is painless. Many find the intramuscular injection of pituitrin (0.5-1 c.c.) of value here. It may act by increasing the coagulability of the blood.

Pain in the chest is here of pleural origin and should be treated as is described under the heading of pleurisy. A little occasional pain of this kind is rather a good omen, as it heralds probable pleural adhesions, which will lessen the chances of a pneumothorax occurring.

Artificial Pneumothorax.—It had long been observed that when a spontaneous pneumothorax happened to occur the lung condition tended to improve. The same thing had been noted after pleural effusion. The collapse of the lung and its consequent rest, seemed to benefit it in the same way as immobility helps an inflamed joint. Some years ago it was suggested (first, I believe, by Cayley and then by Forlanini and by B. Murphy) that we might get these good results without danger of infection by the production of artificial pneumothorax. This has now been done in very many cases and has, indeed, become a recognised method of treatment.

When the infection is limited to one lung very largely, and the case is not doing well, then this little operation should be considered. It is also the most certain way of checking an haemoptysis and may be resorted to when this persists and resists other therapy.

¹*Guy's Hospital Gazette*, 1918.

There are many forms of apparatus now in use and here will only be considered the principles of the method, as details so largely depend upon the special apparatus used.

The patient should first be X-rayed in order to see if the lung that will have to do all the work is in fair condition. Then, after a preliminary hypodermic of morphia, a hollow needle is introduced, under local anaesthesia, into the 6th, 7th or 8th intercostal space about the midaxillary line. To the needle is attached a rubber tube which goes to a three-way metal fitting. To one of the limbs of this is connected a water manometer, while the other leads to a container of oxygen. This last tube is then clamped. As soon as the needle is in the pleural cavity, the manometer will register a slightly negative pressure and the water in it will oscillate up and down with the respiration. When this occurs the oxygen is turned on and passes into the pleural cavity, at first under a slight negative pressure, but later, by a simple arrangement, the pressure is raised, although seldom beyond that of 10 mm. of water. At the first operation not more than 500 c.c. of the gas is allowed to enter. Next day we may introduce 1,000 c.c., and the same amount on each subsequent day until the lung is collapsed. This is judged by the use of the fluoroscope. At the commencement of the operation each day, oxygen should be used to avoid any danger in case the needle should be in a vein, but as soon as it is clear from the free oscillation in the manometer that the needle lies in the pleura, then nitrogen or simply filtered air is usually substituted for the rest of the sitting. A pleura usually takes about 3,500 c.c. before the lung is completely collapsed. After that has occurred the lung may be kept in that state for months by the occasional introduction of more gas into the pleura. It is not necessary, however, to completely collapse the lung, nor is it always possible, on account of pleural adhesions. The immediate benefit to the patient is usually great. Any haemoptysis stops, any fever is lowered, the cough lessens, and altogether he improves. Unfortunately, as said, it is not always possible to collapse the lung on account of adhesions and one may have to try the needle in several places before even getting into the pleural sac, and sometimes may have to abandon the attempt alto-

gether. Sudden syncope has occurred during the operation, as it has during the performance of a paracentesis, but it is very rare in both cases and personally I have not come across it. It is probably less apt to happen if we always use a preliminary dose of morphia. It has been ascribed to a pleural reflex, but we occasionally see syncope occur during the most trivial operations on any part of the body. Air embolus has been reported, but should not occur if no gas is allowed to enter until the manometer shows that the needle is in the pleural sac and if, as a further precaution, we always commence with oxygen; for the passing of even considerable oxygen into a vein will do no harm. Quite commonly, some interstitial emphysema appears at the site of the skin puncture, but does no harm and disappears in a day or two.

Such is the outline of this little operation. For fuller details the reader is referred to any reference manual. Suffice it to say, it seems that in artificial pneumothorax we have a very valuable method of dealing with cases of pulmonary phthisis that are not doing well under simple medical and hygienic treatment. It has been shown that the method can be sometimes used even when both lungs are infected. These may be alternately collapsed or both partially so at the same time.

In certain rare cases of fibroid phthisis where there is a large cavity which cannot heal on account of its size, resection of several ribs has been successfully practised with the object of allowing the chest to sink in over the cavity.

Tonics are often indicated in pulmonary phthisis. The chief one is cod liver oil, as already mentioned, but nux vomica, iron, malt extracts and the hypophosphites, are all much used. Arsenic is of special value here and will frequently cause a gain in weight. Theodore Williams showed that in the time of Laennec, the average duration of the life of a phthisical patient was two years, while in 1870, after the tonic treatment of the disease had become fully established, it had risen to eight years. Since that date, chiefly, no doubt, owing to the free use of fresh air, the probable duration of life has greatly increased and very many cases are practically cured.

The treatment of Tuberculous Joints is chiefly that of pro-

longed rest of the part, in addition to all the general care already outlined. Often such joints will have to be opened or otherwise treated surgically. Tuberculous glands also usually yield to general measures, but when they tend to soften or are very large, they should be removed. Even then, the medical care is important and should be continued, as it is very difficult for the surgeon to be sure that he has removed every focus of disease. Tuberculin is specially valuable here.

TUBERCULOUS PERITONITIS calls for all general measures. If there be much ascites the fluid should be removed by aspiration or siphonage. This may be sufficient, but if the effusion recur, then the abdomen should be opened. Often the tapping or even more, the mere opening of the peritoneal cavity, will turn the scale and these patients will practically completely recover. Sometimes there may be little fluid but great and massive thickening of the peritoneum, with many adhesions. Even here, the opening of the peritoneal cavity may bring about a return to health, although the exact way in which the operation acts is quite obscure. One case is recalled where a man of fifty had a large mass in the upper abdomen, which, along with general cachexia, suggested malignancy. The abdomen was explored and the great omentum was found matted together and adherent to the liver. Nothing more was done. The patient mended from that time and in the next six months put on fifty pounds in weight. He remained well. (*vide* page 336 for further discussion of this subject.)

CHAPTER XII.

DISEASES OF THE CIRCULATION.

FUNCTIONAL DISTURBANCES OF THE CIRCULATION.

Circulatory disorders may well be considered under the classification which was used by the late Professor John Wyllie of Edinburgh, as follows:—

- (1) Functional disorders.
- (2) Interference with the heart's action from without.
- (3) Endocarditis, acute and chronic.
- (4) Diseases of the muscular substance of the heart.
- (5) Obstruction to the peripheral circulation:—
(a) systemic; (b) pulmonary.
- (6) Vascular disturbance and disease.

But from a treatment point of view we will alter classes (3) and (4) to "The Heart in Acute Conditions," and "Cardiac Failure in Chronic Conditions."

FUNCTIONAL DISTURBANCES OF THE CIRCULATION.

In this class come all the disorders of the circulation which do not depend upon any organic lesion. The group comprises by far the greatest number of circulatory disturbances with which the practitioner has to deal. Generally these disorders are characterized by symptoms rather than by signs, although it is usually noticeable that the rate of the heart is increased, especially on any exertion. Often the trouble appears to be merely a hyperconsciousness of the heart's action. The afferent impulses which are constantly coming to the brain from the heart as from every organ in the body, and which are not normally transmitted to the sphere of consciousness, are now felt here and may be interpreted as discomfort or even as actual pain. The patient is thus abnormally conscious of the normal action of the heart. But any of the five functions of

the heart muscle (stimulus production, excitability, conductivity, contractility and tonicity) may be altered, with the production of corresponding symptoms and signs. Also the nervous control of the organ may be affected, and this very commonly is the case.

In functional conditions the pulse rate is usually too rapid, but occasionally it is slower than normal.

Although such conditions are often spoken of as disturbances of the heart, it is well to remember that the whole circulatory apparatus, vessels, nerves and heart, is one system and all parts share in the disorder. Thus, when a patient has an irritable heart, he has also irritable vessels, and so on. In the same way, when toxins play their common part in disturbing the heart it must not be forgotten that they are also affecting the whole circulatory system.

The circulatory neuro-muscular apparatus may be unduly irritable. This irritability may be an inherited one or be due to the toxins of various infections, or of alimentary or metabolic origin, or introduced from without, as in the irritability following excessive use of alcohol, tea, coffee or tobacco. Irritability is frequently of nervous origin and the common belief now is that "soldier's heart" is really of this nature, and is an example of neurasthenia.

Again, the circulation may be disturbed reflexly and many of the cases of cardiac distress that are associated with gastric and intestinal troubles are doubtless of this nature, although here we also have the alimentary toxic factor coming in and also mechanical interference of the heart from without. A good example of a disturbed circulation due to toxins produced within the body is seen in Graves' disease, of which more anon.

The general treatment of functional conditions of the circulation will be discussed here, and then special reference will be made to certain forms of these which have almost become entities, such as Graves' disease, the irritable heart of soldiers, and paroxysmal tachycardia.

Diagnosis.—A thorough examination of every case presenting circulatory symptoms must be made before the treatment can be considered. The chief object of this is to make

as sure as we possibly can that there is no organic basis for the symptoms complained of. But, also, if the case proves to be merely functional, the very fact of such a thorough examination having been made will strengthen the patient's belief in the physician's final dictum that there is nothing physically the matter with the heart, and this will go far to relieve the apprehension of the patient and thus to put him in the psychic poise which is so necessary for his recovery. Such an opinion, stated by a doctor who has not made a detailed examination, will inspire little faith, and the patient will probably go elsewhere for advice and will act wisely in so doing.

In the great majority of cases when an individual comes to his doctor complaining of his heart, it will be found that there is no organic disease present. In true heart disease the symptoms are not commonly suggestive to the lay mind of heart trouble.

In many cases of organic heart disease the patient has not been aware that there was anything wrong with this organ until some doctor had after an examination told him so. Under this heading come many cases of fully-compensated valvular disease. Very commonly again, the examiner may detect a sinus irregularity, and in military practice one saw many such diagnosed as heart disease. The same remark applies almost as much to cases of premature beats (extra-systoles), although here very frequently the patient has himself complained of the "stoppages of the heart." In all doubtful cases of irregularity, it is well to try the effect of exercise. It may be said as a rule that any irregularity that tends to disappear when the heart is thus hastened is of little significance. The graver forms, such as pulsus alternans, auricular fibrillation and heart block will not thus clear up.

Environment.—When the physician after an exhaustive examination of the patient comes to the conclusion that he has not got organic disease, or, even if some lesion is found, that it is not responsible for the symptoms, then this fact stated to the patient will, as already said, do much to relieve him of his apprehension. It is surprising in most cases how the patient's symptoms clear up when he has thoroughly grasped the idea that he is not the victim of "heart disease," with all

the fear of sudden death and other dire sequences that to the lay mind always follow in the wake of such a condition. He can now afford, and will often learn, to ignore the symptoms that before led him to believe that his days were numbered and that in the few years that might remain to him he must avoid all exercise and games, and, in fact, live the life of an invalid, watching everything that he may eat and probably taking medicines which here will only do him harm.

It is important to repeat that even where a patient has a heart murmur, and an organic one at that, yet all his symptoms may be functional, and not in any way due to the valvular lesion that happens to be there, but is in his case doing no harm. Only too often these symptoms all date from the time when some indiscreet doctor has discovered such a murmur in the course of an examination and has unwisely told the patient that he is suffering from heart disease. When an organic lesion is really interfering with the mechanism of the circulation, the symptoms are usually of quite a different kind to those which occur in functional disease.

The patient should be urged to live as normal a life as possible. Exercise, always short of fatigue and especially of dyspnoea, is not only allowable but usually of the very greatest value, and here games which involve exertion, such as golf, cricket and even football, riding, and walks with an object, are all to be recommended rather than exercise merely for exercise's sake. Exertion taken with some such object has a much more beneficial effect upon these patients than mere exercise prescribed by a doctor, as he would a medicine. When taken with some object it keeps the patient's mind off his condition, and this is very important here.

There is one exception to the use of exercise in supposedly functional heart cases, and that is when the condition follows infections of various kinds. Here the myocardium may have been more or less damaged or at least poisoned, and rest may for some time be necessary, and exercise only later and very gradually be substituted for it.

Diet.—A good plain ordinary diet is the best here. It is well to limit the amount of nitrogenous food, such as flesh and fowl, fish, eggs, also tea and coffee. These patients

should smoke very little, and should take no alcohol. It is an interesting fact that most of them have found out for themselves that alcohol, and often tobacco, does not suit them. The meals should not be bulky, especially if the patient has noticed that his symptoms are worse after eating, which is often the case.

Specific Treatment.—In very many of these patients there is an underlying nervous instability which cannot well be removed, although it may usually be lessened by treatment directed to building up the nervous system. But in other cases the exciting cause can often be got rid of with great benefit to the sufferer. In many instances there is some underlying chronic infection such as trench fever or malaria or there may be poisoning from some local septic focus. Excesses of tea, coffee or alcohol, derangements of the alimentary tract, over-work and especially nervous strain and worries, may all be at the root of the matter and the case will not improve until they are properly treated.

Symptomatic Treatment.—Often the symptoms will disappear when the patient has been assured of the harmlessness of his condition, or when we have removed some cause, but frequently the heart will remain irritable for long after the cause has been removed. It might almost be said that it had acquired the habit of irritability. In such cases the bromides and carminatives are of use and may be given freely. Such a prescription as the following has often proved valuable in my hands:—

R	Strontii Bromid.	5 iij.
	Liq. Arsenical.	5 ss.
	Spirit. Chloroform.	5 ij.
	Extract. Glycyrrhiz. Liq.	5 ss.
	Aq. Menth. Pip.	ad 5 vj.
	Misce.	

Sig.—A tablespoonful in water three times daily after meals.

When palpitation is troublesome, the sipping of water will often control it, acting reflexly through the vagus. Locally,

applications to the precordium, either heat in the form of a turpentine stupe, or cold in the form of an ice bag, will often give relief during a bad spell.

These patients frequently require tonics, such as iron and arsenic. As a rule strychnine should not be given, as it tends to increase the irritability.

Resumé.—Remove the cause if possible; raise the general health in every available way; regular graduated exercises; much assurance.

Paroxysmal Tachycardia.

In this condition we have paroxysms of rapid action of the heart. The attacks begin and end suddenly and are thus distinguished from ordinary rapid heart and from palpitation.

The rhythm of the heart during the paroxysms may be regular or irregular. In the former case the cause is nearly always auricular flutter. Here the auricle has taken on a very rapid rhythm as a result of a centre of increased irritability in its tissues which originates impulses at a very rapid rate. Usually, although the auricle is thus beating very fast, the ventricle is not hastened and only responds to perhaps every second or third impulse that comes to it from the auricle. But occasionally it suddenly commences to so respond and thus takes on the same rapid rate as the auricle, and now an attack of paroxysmal tachycardia is on.

After thus running at the auricular rate for a period varying from a few minutes to months, the ventricle will suddenly cease to respond to all the impulses and hence will drop back to its old rate, and the paroxysm is over.

When paroxysms of rapid heart-rate occur in which the rhythm is irregular the underlying condition is probably a passing attack of auricular fibrillation.

As a rule, paroxysmal tachycardia is not dangerous to life, but occasionally the paroxysms will last so long that the heart becomes worn out and will dilate and acutely fail. Such a failing case will show remarkable distension of the veins at the root of the neck.

Treatment.—All the general treatment mentioned above may be employed, but digitalis is here often of great value.

In auricular flutter, if this be pushed, the case may change to one of fibrillation and then, when this fibrillation, produced by digitalis, disappears, as it will probably do after the drug is stopped, the heart may resume a normal rhythm.

Equally, when the condition is due to auricular fibrillation, digitalis is of benefit and should be freely given until the ventricular rate is slowed to perhaps 70.

Irritable Heart. (Soldier's Heart.)

This is a very common condition in war time and in all the armies engaged in the recent struggle there were very many soldiers invalided from this cause, or partially incapacitated and only fit for low-grade duties, but it is often seen in civil practice. The exact nature of the condition is much in dispute, some attributing it to a toxæmia, some to heart-strain and so on, but the favourite view now held (and in my humble opinion the correct one) is that in most cases the condition is really one of neurasthenia of a circulatory type. The symptoms are termed the "effort syndrome,"—rapid heart action, palpitation, cardiac pain, exhaustion, &c., all usually precipitated by exertion. But the patient nearly always shows nervous symptoms even when at rest, such as tremor, sweating, vaso-motor instability, and so on.

Treatment.—Where the cases vary in severity from those that are practically normal to those that are completely incapacitated, the treatment must naturally vary too. If every man who complained of weakness, palpitation, some breathlessness and dizziness, had been considered a case of "soldier's heart" and been accordingly invalided, there would have been a terrible casualty list in the army! The great majority of the cases were so slight that all that was required was a few directions about the general health and a firm but kind assurance that the heart was all right, and they were able to return to duty. The more severe cases require rest to begin with, but must soon be got up and urged to take exercise. In the army the treatment by regular graduated exercises was greatly developed and proved of much value in getting many of these patients back to a normal state of health. The value of games is much emphasized by Sir James Mackenzie, and

everyone knows how much easier it is to thus get exercise than if this be merely taken as a medicine, so much a day.

The return to health will always be slow and the patient needs to be constantly encouraged. "We must avoid," as Sir James Mackenzie says, "the grievous injury that is done to the sick soldier by emphasizing in his mind the depressing idea that he suffers from an affection of the heart." That is to say, we must assure him that he has not got "heart disease," a term which suggests to the laity such a gruesome outlook.

Any possible sources of sepsis, such as *pyorrhoea alveolaris*, should be attended to, and the digestive tract carefully looked after. The diet must be simple and nutritious, and tea, coffee, tobacco, alcohol and meat greatly restricted.

Drugs, beyond those suitable for special states, such as constipation and anaemia, are of little value. Digitalis has no influence here. Bromides, especially the strontium salt, are of use when the nervous element is prominent.

Two special treatments have been advocated, viz., hydropathy and the use of the X-ray over the thyroid gland. They may occasionally be of some value, but the series of cases that have been published in their favour are far from convincing.

TOXIC DYSPNŒA.

It is not uncommon to see patients who suffer from dyspnoea, especially at night, and yet physical and other examinations fail to reveal any abnormality and there is probably an absence of cyanosis. Often the blood pressure is high, but not necessarily so, and the urine may or may not contain a trace of albumen and an occasional cast.

The so-called "Cardiac Asthma" is of this type as is also the *Dyspnée toxi-alimentaire* of Huchard. It is now believed that these patients are suffering from acidosis, the acid bodies concerned being unknown, but are certainly non-volatile. In all probability there are various toxins involved and Huchard's name seems a good one.

The treatment of this condition is not cardiac at all, but

rather eliminative. Purging, the use of diuretics, and in bad cases venesection, are all sometimes of value. Large doses of alkalies are often of use here. The diet should be low in proteins.

In all heart cases there is probably a degree of toxæmia, but in the condition under consideration this is the chief feature of the case.

SYNCOPE.

Fainting is more commonly due to nervous than to cardiac conditions. It is a comparatively rare incident in heart disease. Anything that lessens the supply of blood to the brain will quickly bring it about. The most common cause of this is vaso-dilation elsewhere, usually in the splanchnic area, with consequent fall of arterial blood pressure, but occasionally it appears to be due to vagal action, the heart being much slowed before the syncope occurs.

The patient falls or at least assumes the horizontal posture and he should be left there until he revives. Generally this is all that is required, but, if he can swallow, a few mouthfuls of strong whisky and water will reflexly revive him, or aromatic spirit of ammonia (sal volatile) may be used instead (a teaspoonful well diluted with water). In bad cases the administration of a hypodermic syringe of sulphuric ether is often of value. It is thus a very rapid and diffusible stimulant.

In people who faint easily some underlying cause may be discoverable, such as anaemia or hypo-adrenia, but frequently no definite cause can be discovered and the condition is due to poor vaso-motor tone. Here the wearing of a well-fitting abdominal belt is often a great comfort. It "girds up the loins."

CHAPTER XIII.

DISEASES OF THE CIRCULATION.

PERICARDITIS. THE HEART IN ACUTE CONDITIONS.

WE often find that the heart is hampered in its action by some pressure from without. The organ itself is sound but its action is mechanically interfered with, and we may thus get serious symptoms and even death from the failure of a healthy heart. The pressure may be from any direction. Thus, from above as also from behind, it may come from an aneurism; from in front or behind, from a mediastinal growth; from either side, due to a collection of fluid or air in the pleura; from below, due to a distended stomach, and from all round the heart in pericarditis with effusion.

The amount of interference with the heart's action from any such pressure seems to depend chiefly upon the rapidity with which the pressure is applied. Thus we find that while a few ounces of blood suddenly poured into the pericardium from a ruptured aneurism will produce death, the pericardium may contain fifty or more ounces of fluid that has slowly accumulated, without showing any decided interference with the circulation.

Most of these causes of pressure are dealt with elsewhere, but the subject of pericarditis may conveniently be discussed here.

PERICARDITIS.

Pericarditis, like other inflammations of serous sacs, may be either dry, or with effusion. It is usually due to a general infection, such as acute rheumatism, septicaemia or tuberculosis. Most commonly the infection is rheumatic and when it occurs here it is practically always accompanied by endocarditis. It is not at all uncommon, however, to find the condition as a complication of pneumonia, in which case the endocardium may escape. Pericarditis often comes on insidiously as a terminal infection.

DRY PERICARDITIS.—There is usually a good deal of pain here, which is often referred to the epigastrium, thus suggesting an abdominal rather than a thoracic cause. The chief danger of dry pericarditis is that the inflammation may involve the myocardium. The later effects of the disease can often be seen in extensive pericardial adhesions which may much hamper the action of the heart. As a rule, however, the heart is “safe but not sound,” the immediate danger to life being small, but the adhesions probably causing disability in after years.

Diagnosis.—Dry pericarditis is revealed chiefly by the occurrence of friction. This is easily heard, and yet no condition seems to be more frequently overlooked. The friction is usually chiefly audible about the base of the heart, but may be heard in some cases all over the precordium. The pain, as mentioned, is often distressing, and sometimes embarrassment of the heart occurs, as shown by breathlessness and a rapid pulse.

Environment.—The patient must be kept absolutely quiet. Usually he can rest in the horizontal position, but may be easier when propped up in bed. Every physical and mental excitement which will cause the heart to beat more rapidly must be avoided.

Diet.—The diet will largely depend upon the general infection from which the patient is probably suffering. As a rule it should be light and chiefly fluid.

Specific Treatment.—When, as is most commonly the case, the general infection is rheumatic fever, this condition must be treated in the usual way with salicylates or alkalies, or better still with the combination of these, as already described under the treatment of acute rheumatism. Other infections are more difficult to treat specifically but appropriate sera may be tried. Vaccines are not indicated here.

Symptomatic Treatment.—If the pain be severe it may be necessary to resort to an opiate. Locally, an ice-bag kept constantly applied to the precordium will tend to relieve the pain and also slow the heart. Many prefer the use of small blisters, one of these (say an inch square) being applied just to the right of the sternum every day, each being put on just below

the previous one. Occasionally several leeches applied over the heart will give much relief.

The pericarditis complicating pneumonia and pleurisy is nearly always a dry one, and often does not seem to add much to the seriousness of the prognosis of the pneumonic attack.

PERICARDITIS WITH EFFUSION.—This condition may follow the dry form or the effusion may occur almost from the first. The cause is always infection of some kind, and is either some general infection, such as rheumatic fever or septicaemia, or a local one spreading from the pleura, or due to a penetrating wound. The tuberculous form is often of very insidious onset.

Diagnosis.—The recognition of any considerable quantity of fluid in the pericardium is usually an easy matter, but mistakes can be made and it is very necessary to be sure that the signs are not due merely to a dilated heart when it is proposed to pass a needle in for the purpose of the withdrawal of some of the fluid. Such a mistake has been made, with fatal consequences.

The **treatment** of the condition is practically that of the dry form, unless the heart shows any signs of embarrassment from pressure, in which case it may become necessary to remove some of the fluid.

In rheumatic cases one should not be in a hurry to puncture the pericardium, as the fluid usually disappears spontaneously after a time. This disappearance may be hastened by local blistering and possibly by the use of purging and diuresis. Of course, if pressure symptoms are at all severe then it will be necessary to remove some of the fluid, but short of this it is better to wait.

When it seems necessary to explore, either because of pressure symptoms or because the probabilities are that the symptoms are due to the presence of pus, the needle, which should be of large calibre, may be passed in cautiously either in the fifth left intercostal space about one inch from the edge of the sternum, or in the fourth right space at the same distance from the right border of this bone. One thus keeps out from the sternum to avoid the possibility of injuring the in-

ternal mammary artery. Or the pericardium may be reached from the left costo-xiphoid angle, the needle being passed in an upward direction through the diaphragm. If the fluid proves to be clear, then as much of it as will come away should be slowly withdrawn. If it is pus then it is best to drain. This is done by cautiously entering at one of the spots mentioned and passing in a soft drainage-tube which should then drain into a frequently-changed aseptic pad of absorbent cotton. There is probably no condition which will produce so much cyanosis as does fluid under pressure in the pericardial sac, and it is wonderful to see how quickly this will disappear when the pressure is removed. In one case, seen with the late Dr. G. A. Peters, the patient, a lad of twelve years, was simply black when he was put on the operating table. As soon as the pus began to flow from the tube he quickly resumed a normal colour. In this case 54 ounces of pus came away at once. The child recovered. There is some danger of producing a pneumothorax when opening the pericardium, especially when this is done from the left side.

THE HEART IN ACUTE CONDITIONS.

ACUTE ENDOCARDITIS may be what is called simple or malignant. These are the two extremes, but we find all grades between them, the severity of the case depending upon the nature and the virulence of the infection.

The usual infections are with *streptococci*, *staphylococci*, *pneumococci* and *gonococci*, and it is often impossible to tell from the examination of a culture, whether this had come from a benign or from a very malignant case. It is all a matter of virulency of infection and degree of resisting power. The *streptococcus viridans* is apt to produce a particularly long drawn-out type of infection.

Diagnosis.—The commonest cause of acute endocarditis is rheumatic fever, and the younger the individual infected the more apt is the heart to be involved. In children the only sign of infection may be so-called “growing pains,” and yet the heart may be badly attacked. It is not our province to discuss in detail the diagnosis of the condition, but one must

emphasize the fact that most cardiac bruits occurring in acute diseases are not due to endocarditis at all, but are "functional" in character and will usually soon clear up. The diagnosis will include the attempt to probe the nature of the infection and also its virulence. Are we dealing with a simple endocarditis, or with a more or less malignant one? In rheumatic fever the heart trouble is nearly always of the former type, as also in chorea.

In the malignant cases septic emboli are apt to occur, and complicate the condition.

Environment.—The patient should be in bed, and not only that, but must be kept as immobile as possible, and not allowed to sit up, unless, indeed, he happen to be dyspnoeic, when he may require to be propped in that position. A bed-pan should be used.

Diet.—The food should be light, and administered in small quantities at short intervals, as any distention of the stomach will hamper the heart.

Specific Treatment.—Unless the case be due to rheumatic fever, in which the free use of alkalies and the salicylates is indicated, we have little power of treating the infection specifically. Most cases of acute heart disease in children are caused by rheumatic infection and such patients are liable to further attacks of the same disease. Consequently it is a wise plan, as suggested by G. A. Sutherland¹, to give them salicylates during all of their adolescent life. For a week in each month they may take 40-60 grains of salicylate of sodium daily, and if any rheumatic symptoms should occur in spite of this then they must be treated as acute cases. In the more malignant cases vaccines have been tried, but the results are not at all convincing. Probably the patient is already poisoned with the toxins of the disease, and any more bacterial products added will only increase the toxæmia. The use of sera for the production of passive immunity is more rational, and they may be tried.

In *streptococcus viridans* cases sodium cacodylate has been a good deal used and with some success. J. A. Capps² records

¹*Brit. Med. Journal*, March 24th, 1923.

²*Trans. Assoc. of American Physicians*, 1922.

8 cases in which he used it, with six recoveries. He gave 1-4 grains intravenously daily, continuing this until the breath gave a strong garlic odour.

Symptomatic Treatment.—Often nothing is here required. In most of the simple cases the heart is safe for the time-being, and there is little discomfort or immediate risk. It need scarcely be said that it is unnecessary to at once administer heart stimulants. As long as this organ is able to do its work, with the patient at complete rest, then it requires no special urging. The pain is usually slight or absent, unless, indeed, there be an accompanying pericarditis, but if it be present, or if there be any palpitation and too-rapid action of the heart, an ice-bag kept constantly applied will give much comfort. One often saw in the Children's Hospital a little patient cry for the ice-bag when it had been removed, so conscious had he become of its soothing effects. A series of small blisters placed, one each day, down the right side of the sternum, as mentioned under pericarditis, is believed by many to have some influence in lessening the endocardial inflammation. After the acuteness has passed and the temperature has become normal, iodide of potash, in five to ten grain doses, may be given, with the idea of helping in the absorption of the inflammatory thickening in the valves.

Prolonged rest is very important, and it is a good plan to make a rule that a patient that has had acute endocarditis should be kept horizontal for three months from the onset, and, of course, as much longer as necessary if there still be any evidence of cardiac distress.

In the subacute type, due to the *streptococcus viridans*, which persists for months, or even years, with very little fever, the patients should be kept in bed as long as there is any evidence of persistence of the infection.

ACUTE MYOCARDIAL FAILURE.—When the heart tends to fail during an acute endocarditis this is not directly due to the endocardial lesion, but shows either that the myocardium is being invaded by the infection as well, or else that the muscle is suffering from toxæmia due to the infection. In many cases the myocardium is alone involved.

When in any condition an acutely inflamed or poisoned myo-

cardium tends to fail it may be necessary to use heart stimulants in order to make it do more work, even if it be weaker. It is like whipping a lame or tired horse, but this must sometimes be done if we would save life.

Diagnosis.—The symptoms of myocardial failure in acute conditions are due either to underfilling of the arteries or overfilling of the veins. The pulse will rise in frequency, and may show some type of irregularity. The blood-pressure usually falls, and the patient is faint, dizzy and breathless, or there may be cyanosis, with engorgement of the veins, as is so often seen pneumonia. It is important to recall here that the whole circulatory apparatus, vessels as well as heart, is involved in most acute infections and toxæmias. The heart usually shows more or less dilatation.

Environment.—If only we could rest the heart muscle completely it might recover, but this is impossible, although we may reduce its work considerably. If we can lower the pulse-rate from, say, 120 to 100 per minute, we rest the heart to the extent of over 15 per cent. Hence the importance of absolute rest, if possible in the horizontal posture. Especially necessary is it that no sudden strain should be put upon the heart, and thus all sources of excitement must be rigidly excluded, such as the visits of most friends, and especially of any one intent on business. Muscular exertion (even in bed) should be equally avoided. This is specially likely to occur during defecation if the bowels be at all constipated. Hence one reason for keeping these open. Sudden sitting up in bed has often been fatal in these acute cases and should be strictly guarded against. In the case of young children it is well to maintain the horizontal posture by the use of a draw-sheet across the upper part of the body.

An ice-bag or sometimes heat to the precordium is often valuable.

Diet.—The diet should be chiefly fluid and always given in frequent small quantities. Occasionally alcohol is required, and it is often well to combine it in the form of whisky with milk.

Specific Treatment.—We can seldom do much here, although some of the infections may be so attacked.

Symptomatic Treatment.—When we have ensured the greatest possible degree of rest for the patient we have done the main thing, but if the symptoms of cardiac distress persist, then something more may be required.

In chronic cardiac failure the great sheet-anchor is digitalis and very many practitioners resort equally to this when the heart is giving way in an acute condition. But modern work makes it more and more evident that where the failure is due to the acute condition alone, then this drug has very little effect. The toxins of the infection are so powerful that they largely prevent it acting. Even where digitalis is pushed until heart-block results, the good effects are seldom anything like as evident as are obtained in chronic cardiac failure. If the use of digitalis were omitted altogether in acute conditions, probably little harm would ensue, and on the other hand, many patients might benefit, as the drug is apt to disturb the stomach. It is only fair to add here, however, that some authorities have more faith than this in the drug.

There are several heart stimulants that are much used in cardiac failure in acute conditions. They sometimes appear to have a good effect, but it must be admitted that our power of influencing the acutely toxic, and even more the acutely inflamed, myocardium by drugs is very limited indeed.

If there is much fever, then hydropathy will, through lowering this, tend to slow the heart, and should be freely resorted to. Cool sponging is the most frequent method employed, or an ice bag may be applied over the precordium. This also tends to relieve cardiac pain if there should happen to be any associated with the condition. Caffeine has a stimulating effect on the heart muscle and the vasomotor-centre. Now, an inflamed overworked organ should rather be rested than stimulated, but occasions arise, as when the heart tends to fail and life is threatened, when for a time it may be necessary to use a whip, and such is caffeine. It tends to rather hasten the heart, but makes the systole more complete. The dose of the citrate is 5 to 10 grains by the mouth, but the effects of the drug can be more quickly and powerfully obtained by giving it hypodermically. Here the caffeine-sodium benzoate may be used in doses of 2 to 5 grains.

Strychnine is frequently given in threatened heart-failure in doses of $1/40$ to $1/20$ of a grain, hypodermically, as often as every four hours. It has little effect upon the blood-pressure, but appears to improve the action of the heart and the patient's sense of *bien etre*, acting as a general stimulant to the nervous system. It also powerfully stimulates the respiratory centre, which action is often valuable in these cases. The drug is slowly excreted, and thus is cumulative, and this should be remembered where it is being freely used for some days on end. Camphor is hypodermically used in this condition. Pharmacologically it has some stimulating effect upon the heart muscle and will revive a heart poisoned to a stand-still by muscarine or chloral hydrate. It tends to dilate the vessels and its combined effect is a hastening of the circulation without rise of blood-pressure. It may be given hypodermically in doses of two to five grains or more, dissolved in olive oil. Even in very large doses it does not depress, but causes a mild delirium.

Morphia is often very valuable in quieting the heart and also in generally relieving the distress of the patient.

When *urgent* heart failure threatens, pituitrin and epinephrin may be of value, but their good action does not last long. The dose of the former hypodermically is $1/2$ to 1 mil, and of the latter (in 1 in 1,000 solution), the same, but they may be given intravenously in half this amount in emergencies.

When the heart has ceased beating and the patient is apparently *in articulo mortis*, the contractions may sometimes be started by the intracardiac injection of adrenalin. There are now many cases on record where this has been successful. The matter is fully discussed by Carl Bodon¹. He recommends that the injection of 1 c.c. of 1-1000 solution be made through the 4th or 5th left intercostal space close to the sternum. The needle, which should be thin and 8 cm. long, enters the right ventricle. The method should be remembered in desperate cases.

There are two drugs that have a powerful but evanescent effect in stimulating the circulation: they are ether and am-

¹*Lancet*, March 24th, 1923, p. 586.

monia. Sulphuric ether in doses of one c.c. (an average hypodermic syringeful) is a powerful stimulant, raising the blood-pressure and hastening the heart, and in threatened death from heart failure it is of great value. In very urgent cases it may be cautiously injected into a vein. The hypodermic injection is somewhat painful. In less severe ones the spirit of ether (Hoffman's anodyne) in doses of $\frac{1}{2}$ to 1 or $1\frac{1}{2}$ drs., well diluted with water, may be given by the mouth.

Ammonia is not well absorbed from the alimentary tract, but acts powerfully reflexly from here, and the aromatic spirit (sal volatile,) containing the carbonate of ammonia, in doses of $\frac{1}{2}$ to 1 teaspoonful in water, is one of the commonest stimulants used. In urgent cases we can give the *liquor ammoniac* into a vein in the leg, in doses of from 3 to 10 minims, well diluted.

Alcohol is an undoubted stimulant here, in spite of all pharmacological findings to the contrary. Its effect is partially reflex, but it tends to stimulate the heart muscle, and dilate the arterioles. In the milder cases of heart failure a good dose of whisky or brandy quickly changes things for the better.

When a patient has recovered from the heart failure in acute conditions he will require much watchful care for a long time, as the damaged myocardium is restored to health very slowly, and any straining of it by unduly calling upon its limited reserve power may have disastrous effects.

CHAPTER XIV.

DISEASES OF THE CIRCULATION.

CHRONIC HEART FAILURE. HEART BLOCK.

Chronic Endocarditis includes two quite separate pathological conditions of the valves of the heart:—(1) the old scarred results of a previous acute inflammation, and here there is really no endocarditis, but only the results of this; (2) a chronic progressive inflammatory process. In both cases we have deformity or thickening of the valves and a tendency to narrowing or dilatation of the orifices, and more or less consequent interference with the mechanical efficiency of the heart. In one case, however, as said, the condition is a fixed one, while in the others it is more or less progressive.

Chronic Myocarditis may succeed an acute attack or occur gradually, and be shown by a slow decrease in the cardiac response to exertion, so that the individual may find himself progressively unable to do things without distress. The condition may be due to some chronic condition or toxæmia, and is very often a degeneration rather than an inflammation. Fatty infiltration of the heart muscle may occur in people who are not otherwise adipose, but is specially apt to be present in such people. It can be much more successfully treated than degeneration.

All the work of the heart is, of course, done by the muscle, and the only effect of valvular lesions is to make that work greater. If a stenosis of an orifice exists, then the blood must be forced through that narrowing, and this implies greater muscular effort. In the same way, when there is leakage of a valve the heart muscle must do more work in order that the circulation may be kept going.

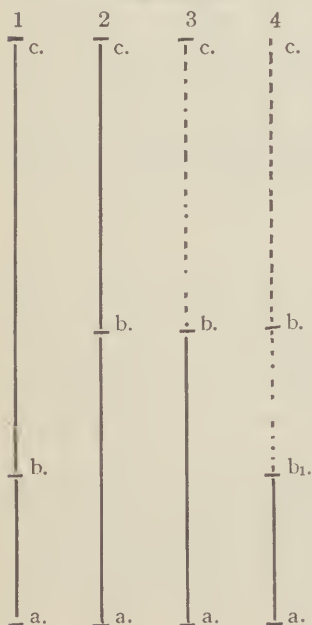
When a heart carries some handicap and yet is able to do its work while the individual lives a normal life, it is said that "compensation is maintained." When, on the other hand, it no longer does its work efficiently while the individual is living

an ordinary life, then we say that "compensation has broken down." In slight degrees of failure it is often said that "compensation is threatened."

The ability of a heart to do efficient work is after all a matter of degree. If sufficient strain is put on any heart it will at last fail to maintain the circulation, but the more hampered it is already with some lesion, the more easily will it yield to an increased strain. And when a heart thus yields, it dilates. A slight degree of dilatation has been shown to call forth a more powerful systole of the ventricles, and thus the heart rises to the emergency during exertion, but if the dilatation be greater than this then the muscle works at a disadvantage.

It is doubtful if a healthy myocardium can be more than temporarily deranged by any strain that can be suddenly put upon it. When a heart is more permanently damaged by such a strain it suggests that it was not previously in a normal condition.

Diagram III.



The relation of the heart to its work is well shown in the Martius' diagrams, which I have ventured to slightly alter by the addition of a fourth stage:—

A-b represents the work that the heart must do when the individual is at rest; b-c the reserve-force of the heart for extra work which it may be called upon to do. Figure 1 represents a normal heart, and a-b is small, and b-c large. Figure 2 is a heart handicapped by some lesion, and a-b is larger so that b-c is smaller and the reserve force is less, unless it be increased by hypertrophy of the heart. Figure 3 represents a heart in which failure is occurring, and

there is no reserve force, but the heart is still able to carry on its necessary work when the patient is at rest. Figure 4 shows the condition of a heart in which compensation is not maintained even during rest; here there is no reserve power and not enough power even for the necessary work (a-b).

It is evident that the whole question of compensation rests upon two factors: (1) the amount of work to be done, and (2) the efficiency of the myocardium. All that a lesion, such as a valvular one, does is to increase the amount of work that the heart must do. When, on the other hand, the myocardium is weakened from some cause, then it may not be able to do the normal amount of work, and hence will tend to dilate. In valvular lesions or an adherent pericardium we can do nothing to alter the morbid changes, but we can, by degrees of rest, lessen the work that must be done, and often are able by appropriate treatment to increase the efficiency of the heart muscle.

1. *Compensation Maintained.*—It is very common indeed to find that an apparently healthy individual has some physical defect in the heart, usually in the form of some valvular lesion. Such a discovery is often made in the course of an examination for entrance to the services or for life insurance.

On being questioned, the individual may show some limitation of cardiac reserve ("His wind is not very good on going upstairs or ascending hills"), but he is otherwise well. Not unfrequently, indeed, no such limitation may be discovered, his hampered heart for the time-being having as much reserve power as a normal one. The heart may be of normal size, or be more or less enlarged, having compensatorily hypertrophied in order to do the extra work that the lesion throws upon it.

Diagnosis.—By a careful investigation of the patient's subjective history and through various physical methods of examination, and especially by testing the effects of exercise upon the circulation, we endeavour to estimate the severity of the handicap that the heart is carrying, and also its power of doing work in spite of this. Is the valvular lesion merely a scarred condition, the result of old valvulitis, or is it the more insidious chronic endocarditis which is apt to be progressive?

Is there an adherent pericardium, or is the myocardium itself defective, and if so, from what condition and to what extent?

Environment.—The patient must not be bluntly told that he has “heart disease,” but it may be explained to him that, for example, one of the heart-valves is not quite right, but that with a little care it may do him no harm, and, indeed, under such care the heart may last longer than many a one not so affected. If he be intelligent it will often be advantageous to use the Martius’ diagram in explaining to him just where he stands. Of course, where we expect the lesion to be a slowly progressive one, it is unnecessary to emphasize this fact.

Our chief object being to keep the heart muscle in as healthy a condition as possible, everything that tends to improve the general health is indicated.

Exercise is here important. This is specially valuable when taken in the open air, and in the form of games or sport. The practitioner will often be besieged with numerous questions of detail as to whether the patient (especially if he be a child and the mother be the questioner) can play cricket, football, baseball, etc. May he swim, dance, and so on? To all these questions he may truly answer, that any exercise is good so long as it does not cause shortness of breath or distress. Any exertion that so acts is apt to be harmful. The healthy heart may with impunity be occasionally overstrained without causing any damage, but now we are dealing with hearts that have a narrower margin of reserve, and thus extra care is necessary. The individual is not ill and all invalidism must be strictly avoided. Often, as already said, a sensible person, conscious that he has to take a little care on account of a leaking heart-valve, will, in consequence of this care, outlive most of his friends who have no such incentive to leading a well-guarded life.

All excesses in stimulants, such as tea, coffee and alcohol should be avoided. Tobacco must be used in great moderation if at all.

A valvular lesion has ruined many a promising life, not because of its effect upon the heart muscle, but because the

patient, having had impressed upon him that he has "heart disease" and perhaps been put upon digitalis and deprived of most things that he desires, has become at last an introspective hypochondriac, with all the ruinous effects of this upon the nervous and general health. But, on the other hand, of late years, it has been taught by many that a valvular lesion is of no significance: that as long as the heart can do its work the defect means nothing. In my humble opinion the pendulum has here swung too far. If an individual, with, say, an aortic or even a mitral regurgitation, ignores it entirely, in time, perhaps, from some illness or as the result of some strain, or, as the years go on, owing to the degeneration of the heart muscle, the handicap which the heart carries will tell. It is far better to let him know that things are not quite right, and then by regulating his life properly he may be able to carry on to well beyond the probable duration of life, while if he ignores it entirely, his heart is likely to break down. Any family practitioner of experience has seen too many people, who had valvular lesions and yet for long were apparently quite well, at last die of heart failure, to believe that these defects are of no account. Insurance results, also, all point in the same direction.

The immediate prognosis of fully-compensated heart lesions may be good, but the ultimate prognosis is a different matter.

The individual—he need not be considered a patient—requires no drugs in this stage of compensation, unless, indeed, these are indicated to meet some special condition, such as anaemia, constipation, etc.

(2) *Compensation Threatened*—It not uncommon to find a person who has some heart lesion, begin to show signs of diminished reserve power. Any little exertion will cause him to have some dyspnoea and cardiac distress. He may have no, or only slight, signs of any breaking down of compensation and the liver will probably not be enlarged. Here, we speak of compensation being "threatened." Such people are often greatly benefitted by specially regulated exercises, the idea being to deliberately train the heart-muscle as one would train any other set of muscles. It was constantly found

in military heart hospitals that patients suffering from organic heart disease were much benefitted by the systematic exercises there given, almost as much so, indeed, as were the cases of "soldier's heart."

In civil life various forms of physical therapy may be used. Massage is often very valuable, or resisted movements where the limbs are passively moved about while the patient more or less resists: also various Swedish movements, or the use of the Zander apparatus, or, indeed, any forms of gymnastics which exercise the muscles, and do not produce breathlessness, or cardiac distress. One of the simplest and most efficient of these is for the patient to lie on his back and rhythmically raise the extended lower limbs a number of times. Walking, first on the level and then up gradual inclines (as was so much developed by Oertel, who also associated with this great restriction of fluids), may next be tried, and golf is here an excellent incentive and lessens the monotony of the treatment.

Hydropathy has been greatly used in such cases, and much difference of opinion exists as to its value. So much depends upon the exact way in which it is carried out. At Spas this is usually done very skilfully, and there is no doubt that many patients get much benefit there. While there, the patient is removed from business and family worries, and lives in pure air and amidst new surroundings. At Nauheim this treatment has been greatly developed, and now in many centres the Nauheim baths are given. The reader is referred for details to the reference manuals, but it may be said that the good effect are largely attributable to the reflex action of the mineral waters (which contain much sodium and calcium chloride and carbonic acid), *plus* the rubbing which is given after the baths.

These patients should also be treated with digitalis, which may lessen the chances of further breakdowns. If auricular fibrillation sets in then they nearly always belong to the next class, of broken compensation.

(3) *Compensation Broken Down*—Here the heart is unable to do its work any more efficiently, and, in most cases, has dilated. As already mentioned, a slight degree of distension actually calls out the best action of the heart muscle.

But when once this slight amount has been exceeded, the heart is in a much worse position for doing its work. The ventricles, which should at each systole move on some three ounces of blood, have now got to deal with four or five, or more. The result is that they do not empty efficiently, and hence the arteries tend to be less well-filled and the veins to be over-filled, and symptoms result. The symptoms of under-filling of the arteries are faintness, dizziness and dyspnoea, while dropsy, cyanosis and venous engorgement of all the organs, with consequent inefficiency of these, result from over-filling of the veins. In disease of the aortic valve and the left ventricle the arterial train of symptoms predominate, while in that of the mitral valve, left auricle and right heart the venous ones are more evident. There are two degrees of broken compensation represented in figures 3 and 4 of diagram III. In "3" the heart can just do its work when the patient keeps absolutely at rest. In the other, "4," it cannot do this, even when the patient is at rest, and propped up in bed. In over 60 per cent. of these cases of broken compensation, the rhythm of the heart is abnormal, the most common form of abnormality here being auricular fibrillation, but in many the rhythm remains unaltered, and yet the heart tends to fail.

Diagnosis.—It is very easy generally to recognize that we have to do with a failing heart, but often hard to make out, in a patient seen for the first time at this stage, exactly what the condition is, although it is evident that the muscle has ceased to be efficient.

Environment.—The patient will be kept in bed, and if necessary, propped up. A bed-rest is here better than any number of pillows. If there be great oedema the patient may not be able to stay in bed at all, and is easier when sitting in an arm-chair with his water-logged legs hanging down. A firm table placed so that he can lean upon it is often a comfort. It is best to allow him to assume the posture which he finds most comfortable, even if it seems to us to be the wrong one theoretically.

He must make no exertion. This applies specially to the act of defecation: many of these patients die at stool.

Hence the importance of keeping the bowels freely opened so that there shall be no straining.

Diet.—If the distress be very great it is well to give no food by the mouth at all for a few days, the nutrition being partially maintained, if necessary, by rectal feeding. As a rule, the meals should be small and often repeated. In the “cardiac diet” of most hospitals there are six instead of the usual three meals a day. All fluids should be restricted, especially when oedema is a marked feature of the case, and often here a strict Karel diet is valuable. In this, during the first seven days, the total food and fluids are limited to 32 ounces of milk daily, given in four meals. On the 8th day one soft-boiled egg, and two pieces of dry toast are added; on the 9th two eggs and four pieces of toast, and on the 10th, 11th and 12th days, chopped meat, rice boiled in milk, vegetables, and one egg. No salt is allowed throughout the course.

In oedematous cases, even when this strict dietary is not followed, it is well to limit the salt-intake.

In cases difficult to feed, alcohol, in the form of whisky, brandy or champagne, is often valuable.

Cane sugar has been frequently recommended recently in heart cases. Sir Arthur Goulston has urged the value of two to four ounces of this daily, when added to the diet. Adamkiewicz states that the heart requires its own weight of sugar (9-11 ounces) for its nourishment daily. This cannot mean sugar as sugar, but rather its equivalent in carbohydrates, as, otherwise, none of us who went through the strict rationing in England during the last two years of the war, where the allowance was eight ounces of sugar a week, would now be here.

Specific Treatment.—None.

Symptomatic Treatment.—There are few conditions in which a careful and skilful treatment of symptoms will more often repay the practitioner than in these failing hearts. Such patients may frequently be drawn back from what looks like certain death and for years may enjoy a fair degree of usefulness and comfort.

Digitalis is the drug upon which we here chiefly rely. The use of *digitalis* in practice practically dates from about the end

of the 18th century, when Withering wrote his classical work entitled: "An Account of the Foxglove and some of its Medical Uses; with practical remarks on Dropsy and other diseases"—but foxglove had been used by the laity for centuries before this in the treatment of dropsy, and was in the London Pharmacopoeia of 1650 and several subsequent editions and then was deleted!

Withering states that his opinion was asked concerning a family recipe for the cure of dropsy. He was told that it had long been a secret of an old Shropshire woman who had sometimes made cures after the doctors had failed. The recipe contained some twenty ingredients, among which Withering recognized foxglove to be the essential one. The remedy was to be pushed until vomiting or purging occurred. Withering was impressed with what he learned, and for the next ten years tried the drug in many cases of dropsy in his private practice, and in hospital cases. Only after that time did he consent to publish his results, and even then only on the urgent solicitation of his friends. "It is much easier to write upon a disease than upon a remedy," he wrote. "The former is in the hands of Nature, and a faithful observer with an eye of tolerable judgment cannot fail to delineate the likeness; the latter will ever be subject to the whims, the inaccuracies and the blunders of mankind." The history of this drug shows well the truth of these pregnant remarks. Few remedies have been so much recommended by some, and condemned by others, in all manner of conditions, but all through its chequered career at the hands of the profession, the truth has stood forth that nothing else possesses such power for good in dropsy associated with a weak, rapid and irregular heart.

Withering's directions for the use of digitalis hold as good to-day as when they were written in 1785—"Let the medicine be continued until it acts either on the stomach, kidney, pulse or the bowels; let it be stopped upon the appearance of any one of these effects, and I will maintain that the patient will not suffer from its exhibition nor the practitioner be disappointed in any reasonable expectation." He stated that about 30 grains of powdered leaf, given in doses of 1 to 3 grains twice

daily, was necessary to produce a commencement of the nausea. By such treatment not only would the dropsy be relieved, but he found that the drug "had a power over the motion of the heart to a degree as yet unobserved in any other medicine."

Since that time digitalis has been credited with many actions besides the relief of dropsy. Thus, Traube taught that its greatest power was in reducing fever and in producing a favorable local effect in pneumonia; and it is interesting here to note a remark of Dr. S. Solis-Cohen¹, that the toxins of pneumonia seem to be able to neutralize quinine and digitalis, so that enormous doses of these drugs may be given without producing cinchonism or digitalis poisoning. This resistance of pneumonia to the action of digitalis is only relative, however, as it is quite possible to produce heart-block and other toxic effects here from its use. But although digitalis had been vaunted in so many conditions, nothing of striking clinical value was added to what Withering wrote until in quite recent years, when the measurement of blood-pressure and the study of the heart's action by the polygraph and the electro-cardiograph have thrown so much light on the way that the drug acts and on the kind of cases that most benefit by its administration. To Sir James Mackenzie's work and instigation especially do we owe much of this recent accurate knowledge; and he has shown, and it has been abundantly confirmed, that the patients very likely to benefit by digitalis are those in which dropsy is associated with a rapid irregular heart and a fibrillating auricle.

The pharmacology of digitalis commenced some thirty years ago, when Schmiedeberg discovered the active principles. A great deal of work has been done since then on these glucosides, but much about them remains uncertain. It is generally admitted that none of the four best known ones—digitoxin, digitalin, digitalein nor digitonin—give the full effect of the whole drug. Hence, most of the modern clinical work has been done with the digitalis itself, either in the form of the tincture, the infusion, or simply as the powdered leaf.

¹*Trans. Amer. Ther. Soc.*, 1913.

Gottlieb states that about 50 per cent. of the digitalis-action is due to the digitoxin which it contains.

The action of digitalis on normal mammalian and frogs' hearts consists chiefly of a blending of two influences, viz.: inhibition through the vagus and stimulation of the heart-muscle. The result is a slower but stronger beat, the heart getting more rest and at the same time doing more efficient work. If the drug be pushed, then the vagal action predominates and the heart is very slow and irregular; at a later stage the muscle stimulation predominates so that the heart becomes fast again and may finally stop in systole, with fibrillation of the auricles. This final stopping of the frog's heart is taken as a physiological standard of the drug and a "frog unit" often used is the amount of digitalis that will stop the frog's heart in 30 minutes.

Clinically, in doses that the human subject can stand, digitalis has very little effect, indeed, in slowing the normal heart or producing diuresis. A heart must be in a certain pathological state in order to readily respond to the drug, and hence it is hard to interpret the effects of digitalis in disease in pharmacological terms. Pharmacologically, the chief cause of the slowing of the heart is stimulation of the inhibitory apparatus, and it may be almost completely removed or prevented from occurring by the use of atropine, but even in an atropinized animal digitalis may slow the heart, the slowing being due then chiefly to a prolongation of systole, and hence digitalis must have some direct action on the heart muscle. That atropine has no stimulating action on the ventricle is well shown in heart block, where the drug hastens the auricles by freeing the heart from vagal control, but the ventricles go on at their old rate. Digitalis has been shown by Cushny to have no effect in lessening the conductivity of the heart in dogs, unless the nutrition of the heart be poor. It undoubtedly does this in some human hearts, as shown by the lengthening of the a-c interval and also the occasional occurrence of partial and even complete heart-block after its use, and hence also this may be a sign that the myocardium is below par in nutrition.

Pharmacologically, the drug seems to increase irritability,

so that a frog's heart, which has stopped after a prolonged perfusion with salt solution, may often be caused to beat again if a little digitalis be added to the solution. But in the diseased heart the excitability usually appears to be lessened by digitalis, and this is probably one reason why the ventricle in auricular fibrillation beats more slowly after the administration of the drug. This lessened irritability is probably due to the improved nutrition of the heart muscle. But occasionally with large doses the irritability of the heart muscle is increased, as shown by frequent extra systoles, and at last even by fibrillation. This is also evidenced by an effect that may be sometimes observed in cases of complete heart block, where after the administration of the drug the ventricle becomes hastened.

Pharmacologically, the drug increases the force of the contractions of the heart and also raises blood-pressure, partly by this increased efficiency of the heart and partly by vaso-constriction. The result is that the blood tends to be less in the veins and more in the arteries. This raising of the blood-pressure does not occur to any extent in normal man, as will be discussed later on.

As already said, digitalis is chiefly of value in cases of dropsy where there is a rapid irregular heart, in a condition of auricular fibrillation. In rapid but regular hearts it has much less effect, although H. A. Christian, G. A. Sutherland and many others have shown that it may slow these when oedema is present, and the former has lately urged¹ that in chronic heart cases it is as useful where the rhythm is regular as when fibrillation exists. In a word, digitalis is indicated in heart failure, especially when the heart is fast and when oedema is present, but often it is useful even when the pulse is slow but oedema is present. I presume that if enormous doses were used we might get some effect in any heart, as we do in animals. The drug is of little service in the rapid hearts of toxæmia, infections and purely nervous conditions. This want of action is variously explained. For instance, Solis-Cohen, as already mentioned, thinks that in toxæmia the toxins and the digitalis glucosides neutralize each other. On the

¹*Trans. Assoc. of Amer. Physicians.* 1922.

other hand, Mackenzie says that the heart is already so under the influence of the poisons that the digitalis will not act. It seems to me, however, that we do not need these explanations, unless, indeed, they will also explain why digitalis has so little action in medicinal doses on the normal human heart. As already said, a special pathological condition of the heart, especially when associated with oedema, is necessary before we can get the full action of the drug from medicinal doses, and this special condition does not happen to exist in toxæmia, infections and many other states.

All the same, there are very many keen clinicians who firmly believe in the value of digitalis in many of these conditions, and possibly there may be an improvement in the tone of the heart and in the strength of its systole, although the effect on its rate is so slight.

Although there are many heart conditions in which digitalis has little evident value, there yet remains the large class of failing hearts with oedema in which its action is often marvellous. Fibrillating cases are characterized by a totally irregular pulse, in which the beats vary in size and in time of appearance. There is usually old mitral disease. Some 60 to 70 per cent. of all heart cases who seek hospital care are found to be of this class. Most of them are the sequence of old rheumatism. A few are due to sclerosis, however, and these are found not to respond so well to digitalis. Until quite recently it was believed and taught that digitalis had a great power of raising the arterial blood-pressure clinically as it undoubtedly does pharmacologically, and hence that it was contra-indicated in conditions where the pressure was already too high, but certainly this effect is a very slight one and has been completely denied by some writers. There is no doubt that when the pressure is low from broken compensation it will greatly rise as a result of the administration of digitalis. Thus in the case of a dropsical arteriosclerotic man who came into the hospital with a pressure of 120 mm., we got a rise of 100 mm. as a sequence of digitalis and he left the hospital with a pressure of 220 mm, and yet feeling much better. In this case 220 mm. was the best pressure in his condition.

On the whole, it seems that the common dread of digitalis

in arteriosclerotic cases is unfounded. If the pressure be still high it will not go higher under the treatment, and if temporarily low from threatened heart failure it will rise as the heart improves, but not beyond what is best for the already abnormal individual.

A word may be said here about the frequent fallacy as regards the pulse-rate, when this is only counted at the wrist. Where the ventricular systoles are not all of equal size and force, as is generally the case in auricular fibrillation, and also in extra-systoles, many of the weaker ones fail to reach the wrist and hence are not counted there. The difference between the pulse as counted at the wrist and the pulse as counted at the apex is called the "pulse-deficit." Thus, if the pulse at the wrist be 60, and at the heart 100, then the deficit is 40. Now, as the heart improves under digitalis, this pulse-deficit becomes less and at last may disappear, every beat which occurs being registered at the wrist. A fallacy may thus come in here and may often be seen when one studies hospital charts where the pulses are as a rule taken in a routine way by nurses. In the example given, the heart may, as it grows stronger, beat only at say 70 per minute instead of 100, and yet, as all the beats now reach the wrist, the pulse will have appeared to have risen to 70, a rise of 10 beats, as there is no longer any pulse-deficit. It is this pulse-deficit that digitalis has the special power of lessening. W. D. James and T. S. Hart¹ have called attention to the fact that digitalis raises the "average blood-pressure" in these cases. If one takes the systolic pressure here, it will be found that the greater the air-pressure in the cuff, the fewer the beats that will reach the wrist, until at last, say at 120 mm., none come through. As the heart improves under digitalis more will come through at a higher pressure, and thus, as James and Hart state, the average pressure is raised by digitalis.

Occasionally it may be well to combine some vaso-dilator, such as the sodium nitrite, with the digitalis, but this will seldom be required. At the same time, we must remember that these arterial cases, in which the heart breaks down sec-

¹*Amer. Jour. of the Med. Sciences*, Jan., 1914.

ondarily to the arteriosclerosis, do not as a rule respond well to digitalis, even if auricular fibrillation be present.

As regards the administration of digitalis when compensation has broken down, the drug should be pushed until its effects are obtained. From one to one and a half drachms of the tincture a day in divided doses is usually sufficient. The first effect is seen about the third day and consists in a strengthening of the pulse waves so that the amplitude of the beats increases and the pulse-pressure is raised and the pulse-deficit lessened. Next diuresis sets in and then the heart slows. When the true pulse gets down to 70 or 60 the digitalis should be stopped, but often before this result is obtained, it has to be discontinued on account of nausea, diarrhoea or headache. After some days, too, the pulse may assume a coupled rhythm, due to the occurrence of ventricular extra-systoles, which is also a sign that the patient has had enough.

The use of massive doses of digitalis in cardiac conditions has come in recently. In 1915 Eggleston advocated the giving of the entire amount of the drug that may be expected to produce the maximum therapeutic effect, in one or several frequently repeated doses. As much as .15 c.c. was given for each pound of body weight. G. C. Robinson¹ later published a series of 100 cases in which this method had been employed; the doses ranged from 15-25 c.c. of the tincture. The effect was apparent in two to five hours after the administration and the maximum result in 24 hours, and the drug continued to show its action for from four to fifteen days; on the average ten days. Such enormous doses may be used where an urgent effect is required and also in hospital practice where the patient is constantly under supervision, but for ordinary cases in private practice the more gradual giving of the drug will probably be safer and in time quite as effectual.

It is fair to say that this massive dosage is not new, as it was advocated by G. W. Balfour in 1875. He gave as much as 70 minims of the tincture every four hours in urgent cases. One should add that recently Eggleston² advises more moderate doses than formerly, now believing that 0.1 cat unit (i.e.,

¹*Trans. Ass. of the Amer. Physicians*, 1919.

²*Archiv. Internal Medicine*, 1922, 30, 133.

one minim of the tincture) per pound of body weight represents the average full therapeutic dose, or less than half of what he formerly advocated.

If the diuresis be insufficient to relieve the dropsy or be tardy in appearing, some diuretic may be given along with the digitalis. Caffeine is very commonly employed here. The plain caffeine is only soluble in 1-68 of water. The citrate in half this amount, but it is only half as strong. The ordinary dose of caffeine is 1-5 grs. and of the citrate, double that amount. Caffeine may be given hypodermically as the double salt of caffeine and sodium benzoate or as caffeine sodio-salicylate. The dose of either is 1-5 grs. Theocin (artificial theophyllin) is often a very potent diuretic here. It is best given by the mouth in five grain doses every four hours for eight doses, and the effect is often marvellous. The sodium-theocin acetate acts in the same way and is not so apt to disturb the stomach. Plain theobromine is often a good diuretic in doses of 1-5 grs. It is less stimulating to the nervous system than is caffeine, which is an advantage. Diuretin (Theobromine sodio-salicylate) is often useful here in doses of 5-15 grs. thrice daily.

In all cases of dropsy concentrated salines are valuable, sufficient to keep the stool fluid and frequent.

When any considerable amount of dropsical fluid occurs in the cavities of the body it may be necessary to remove it mechanically.

In severe oedema of the legs drainage may be required and this may be accomplished by the use of Southey's tubes or by multiple incisions. After the latter, the treated limb is wrapped in absorbent cotton. The external genitals may have to be treated in the same way.

Even a better method than these is the simple puncture of the skin in several places with a surgical needle. The most oedematous parts should be chosen and the punctures done after the skin has been sterilized as for a surgical operation. An enormous amount of fluid can be drained away by such mechanical methods and it will often be found that a diuresis also sets in and that drugs, such as digitalis and caffeine which at first were ineffectual, now begin to act.

When compensation has become more or less restored, a

moderate dose of digitalis may be given, such as ten drops of the tincture twice daily, and this can be continued with advantage for long periods. These patients often learn the exact dose which best suits them, and may keep fairly well for years while taking it. The drug does not appear to lose its effect from long-continued administration.

It has been found that the average excretion of digitalis by the human body is 20 minims of the tincture, i.e., two grains of the leaf, so that when once a patient has been got well under the influence of the drug this amount daily should be sufficient to keep up the effect. But there is much individual variation in the excretion and hence each patient becomes a separate study.

In cases that do not respond well to digitalis, *Strophanthus* may be tried. This acts in a very similar way, but, pharmacologically, produces less vaso-constriction and is a more powerful diuretic. It is a more energetic muscle poison than digitalis and an equal dosage is some eight times as toxic. The B.P. dose of the tincture is only two to five minims.

Squills acts on the heart in the same manner. It has also an expectorant action, and is much used for that purpose, and is specially valuable where heart cases are complicated with chronic bronchitis.

Some cases of failing heart only come under our care when they are *in extremis*, and in them one cannot wait for days for the ordinary effects of digitalis. Here the massive doses may be tried, or *Strophanthin* can be used. *Strophanthin* may be given either intravenously or intramuscularly in a dose of $1/250$ grain. This amount may be doubled in desperate cases, and halved in slighter ones. The digitalis-like effect is apparent in a few hours, and the action may then be kept up by giving digitalis by the mouth. *Strophanthin* is a very toxic body and we must be very cautious in giving it when the patient is already under digitalis.

When the cyanosis is very marked venesection should be performed and will sometimes temporarily help the heart until drugs have time to act. (*Vide* Chapter XVIII.)

When engorgement of the liver is great Guy's pills are of special value.

Oxygen, properly administered, may help the dyspnoeic cases considerably; will tend to lessen the cyanosis, and if Cheyne-Stoke respiration be present will almost certainly relieve this for the time-being. (Chapter XVII.)

So far we have been discussing heart cases that first come under treatment with compensation more or less broken down, and the most that can be hoped for is that they may be temporarily restored to a fair state of health. But the vast majority of heart cases are not in this low condition when first they consult their doctor, and in them, in addition to all the general directions which must be given to them as to diet, rest, &c., small doses of digitalis taken for long periods may be of great value in preventing a breakdown, just as after such a collapse they lessen the chances of recurrence. The value of this procedure was much urged by the French therapist, Huchard.

As already said, the active principles of digitalis are very uncertain, and can be little relied upon in practice. Perhaps the best is Nativelle's crystalline digitalin. This is a favourite in France and owes its popularity to Huchard. It consists chiefly of digitoxin, and one granule corresponds in action to about 15 minims of the B.P. tincture. Most of the "digitalins" on the market are impure and uncertain in action. They are usually mixtures of digitalin and digitoxin. As regards digitalis itself, the common belief is that the various preparations are uncertain in strength. Sir James Mackenzie and Professor Cushny did not find this to be the case in England, but on this continent great differences in quality have been shown to exist. Thus, V. E. Henderson¹ points out that while the Pharmacopoeia of the United States of 1916 requires the pharmacological standardization of the drug, the B.P., 1914, does not do so, and he found by actual testing that many of the preparations on the Canadian market were very weak, and D. S. Lewis & C. F. Moffat² confirm this. Hence, one should always be careful to use only preparations made by a reliable firm. It is known that the glucosides of digitalis readily undergo decomposition, forming resinous bodies, which

¹*Canadian Med. Monthly*, 1921.

²*Canadian Med. Ass. Journal*, Oct. 21st, 1921.

are very toxic and which in animals will produce convulsions. It is possible that the occasional cerebral symptoms that arise in man during the administration of the drug may be due to the same cause.

Fifteen minims of the B. P. tincture, 1 Nativelle granule and one Guy's pill, all about correspond in strength of action.

Digipuratum is an excellent form in which to give digitalis, but it is now difficult to obtain. It contains all the active principles of the drug, but is standardized and moreover is very stable and also non-irritating. One gramme of it equals eighty frog units. It is thus of the same strength as the powdered leaf, but more certain and less irritating. It will keep for years, and some that I had for nearly four years was tested by Professor V. E. Henderson and found to be quite up to strength.

Digitalis may produce nausea and vomiting in two ways: (1) by direct irritation of the gastric mucous membrane, and (2), after some days, by its effect on the vomiting centre, or perhaps reflecting from the heart. Often one sees nausea and vomiting as a result of cardiac failure, and such cases are relieved by digitalis, and the drug should never be withheld in an otherwise suitable case simply because this symptom exists.

Infusion of digitalis is a favourite preparation with many, but must be freshly prepared. Certain theoretical objections have been made to it, on account of the fact that digitoxin is insoluble in water, but, as is so often the case with theoretical objections, in practice this does not hold, and many physicians prefer the infusion to all other preparations. Probably the digitonin, as a saponin body, helps to hold the digitoxin in solution.

Contraindications to the use of digitalis are not many, but the drug is too often given in a haphazard way in cases where it can be of no use, and is relied on where other remedial measures should instead be used. In case of partial heart-block it is distinctly contraindicated, and may be dangerous by suddenly increasing the block. It has long been believed that it should not be given in aortic regurgitation, the theoretical argument used being that, as the drug prolongs the dias-

tole, it allows of a longer leakage. Where the case is one of pure aortic regurgitation it will probably not be indicated anyhow, but where mitral regurgitation sets in secondarily, or is conjointly present, and the heart is breaking down, then the drug does good. If digitalis be stopped as soon as any of its toxic effects appear, such as nausea, vomiting, diarrhoea, headache, or a slow or coupled heart-beat, then probably no danger is run by its use. As already said, if other indications are present, the mere existence of high blood-pressure does not contraindicate the giving of digitalis.

Another remedy has recently been much used in auricular fibrillation. It had long been known that cinchona was of value in heart failure and in 1914 Wenckebach definitely showed that it could occasionally terminate auricular fibrillation. Frey next found that it was Quinidine that so acted and now many cases have been recorded where quinidine sulphate in doses of 0.2-0.6 grammes t.i.d. will restore the normal rhythm. This occurs in about fifty per cent. of cases. The normal rhythm may then persist for days or months and is accompanied by great recovery in compensation. The pharmacological action of the drug is very complicated but Lewis believes that its good effects are due to the prolongation of the refractory period of the heart muscle so that the "circular movement" of the auricle is broken. Even when the fibrillation is not stopped the auricle may show a very great slowing of its contractions which is no doubt due to decrease in conduction. Quinidine should also for this reason be useful in auricular flutter. In the Toronto General Hospital amongst many cases of auricular fibrillation treated with quinidine about half of them resumed a normal rhythm, as shown in a paper published by Oille and Jamieson¹, but quinidine sulphate is a powerful drug and is yet on its trial and it should not be used in a routine way until it has been more thoroughly studied. When heart failure is present, with or without fibrillation, digitalis still remains our most reliable remedy.

Many practitioners have used Sparteine in cases of cardiac failure but there is little evidence that it can at all take the place of digitalis.

¹*Can. Med. Assoc. Journal*, May, 1923.

Insomnia is often a distressing symptom in heart failure, and when necessary the non-depressing hypnotics should first be tried. (Page 432.) Sometimes it will be necessary to give morphia.

OBSTRUCTION OF THE PERIPHERAL CIRCULATIONS.

A. Pulmonary.—In many cases of primary pulmonary disease, especially in emphysema, there is much obstruction to the onward flow of blood in the lungs, and at last the patient begins to show signs of circulatory failure, with oedema, cyanosis, &c.

It is probable that as long as the heart-muscle remains healthy it can do the extra work which is thrown upon it, but certainly the exciting cause of the failure is the obstruction to the pulmonary circulation.

The treatment here is much like that of primary heart failure, but the pulmonary condition must also be taken into account. There is nearly always an associated bronchitis, and it is then that Squills is specially valuable. This drug is a stimulating expectorant, and also has an action on the heart very similar to that of digitalis. The tincture may be used in doses of 5-15 minims, or even more, or we can well employ the Guy's pill.

B. Systemic.—The commonest cause of obstruction in the systemic circulation is generalized arterio-sclerosis, especially when this involves the aorta and the splanchnic vessels. Before the heart fails, the myocardium will have shared in the general circulatory degeneration and hence is not sound. The treatment of this condition is discussed under the headings of arterio-sclerosis and heart-failure in chronic conditions.

HEART-BLOCK.

In this condition the impulses from the auricles to the ventricles pass with difficulty through the Bundle of His, or are altogether unable to do so. In the former case we have the state of Partial and in the latter of Complete heart-block.

Heart-block may be temporary, as occurs in fevers like

pneumonia or in toxaemias as in digitalis-poisoning, but is commonly permanent and due to organic disease of the tissues of the bundle. This disease may be localized to the bundle but is often only part of a more general myocardial change and the symptoms in a case may reflect this general myocardial involvement.

The symptoms are due to cerebral anaemia produced by the slowness of the ventricular systoles. If the ventricles pause for a few beats, dizziness and even syncope will result (Stokes-Adams syndrome), and if the pause be longer then death may occur.

In the cases occurring in acute conditions and in all bad examples, rest in bed is necessary, but in the slighter cases the patients may get about, and some of these people can keep going for years and with care go on with their work. I have watched one case of partial block for 19 years. He is now 74 and is able for much office work. The block has lately become complete and he feels better in consequence.

The underlying cause should be sought for and may in some cases, under appropriate treatment, be removed. If syphilis be present it should be thoroughly treated.

Symptomatic Treatment.—Atropine will often lessen and even relieve heart-block and may be given in doses of 1/100 gr. hypodermically and repeated as required. There is some experimental evidence that epinephrin will sometimes remove the block. It sometimes increases the ventricular rate in complete heart block, probably by direct stimulation of the auriculo-ventricular node or below this, and may be of value when Stokes Adams attacks occur owing to periodic stoppage of the already slow ventricle. In partial block digitalis is contra-indicated as it may still further decrease the conductivity. In complete block this objection does not apply and the drug may be used when otherwise it is indicated. In such cases it may increase the speed of the ventricle, as this is now beyond vagal control.

In the syncopal attacks, various rapid stimulants, such as sulphuric ether or caffeine, hypodermically, are of value.

CHAPTER XV.

DISEASES OF THE CIRCULATION.

HYPERPEIESIS AND ARTERIOSCLEROSIS. ANGINA PECTORIS.
ANEURISM. PHLEBITIS.

HYPERPEIESIS and ARTERIOSCLEROSIS.

This is a very common disease nowadays, but it was present in ancient times and has been found in Egyptian mummies. It also occurs in animals. It is extremely hereditary.

A useful etiological classification of the disease is the one given by Sir T. Clifford Allbutt, as follows:—

1. Cases due to heightened blood-pressure, persistent or occasional (Hyperpiesis).

2. Those induced by toxæmia, such as occurs in some diseases, such as typhoid, malaria, and syphilis, &c. Also in lead poisoning, gout, alimentary toxæmia, nephritis, &c., and possibly from alcohol and tobacco. Here the various toxins either act directly upon the vessel wall, producing inflammatory changes there, or else cause vasomotor contraction and thus produce the condition as a secondary one to heightened blood-pressure, as in Class 1. Many toxins (for example, nicotine) may act in both ways.

In this class the blood-pressure may or may not be raised.

3. Those due to senile involutionary changes. Sooner or later, as age advances, a certain degree of degeneration occurs in the vessel and heart walls, but in some people this takes place sooner and to a greater extent than in others. It has been well said that a man is only as old as his arteries. This tendency to early degeneration runs in families. The blood-pressure in this class is often not raised at all, although, on the whole, this pressure tends to rise as age advances, so that a pressure of say 140 or even 150 mm, while abnormal in a man of thirty, may be looked on as normal in one past middle life.

It has been shown that when arteriosclerosis is the cause

of a raised blood-pressure then this has involved the splanchnic arteries or the aorta. Arteriosclerosis without any rise in blood-pressure requires little treatment as a rule. It is the toxic form, with a raised pressure, for which so much can often be done. It is important to remember here that many cases of arteriosclerosis, with usually a normal blood-pressure, may have intercurrent attacks of rise from toxæmia, which are very amenable to treatment. Huchard well said that arteriosclerosis began as a toxæmia, continued as a toxæmia and ended as a toxæmia.

Diagnosis.—Here we must endeavour to ascertain to what class the patient belongs, and find out, if possible, the underlying cause of his sclerosis. What is the state of the heart and the kidneys? If the blood-pressure is high, is this due to a toxin (the most frequent cause) or is it simply compensatory? Is it due to simple nervousness, or is it produced by pure arteriosclerosis? A good method of testing the degree to which vascular spasm is responsible for the rise in pressure is to give a dose of nitroglycerin (1/100 gr. by the mouth), and see the effect of this upon the pressure. If this falls considerably then we know some of it at least is due to vascular spasm, and such cases are probably largely toxic or nervous and can be benefitted by appropriate treatment. Sir Clifford laid down the good rule that every individual of 40 and over, should, at intervals of five years or so, have the blood-pressure measured in order that he may know in time if he be tending towards arteriosclerosis.

In many cases no definite cause can be found for a raised blood pressure and such a state is termed “essential hyperpeiesis.”

The following three stages may be recognized in toxæmic arteriosclerosis:—

First Stage.—(1) Toxæmia.

Second Stage.—(1) Toxæmia; (2) organic changes in the walls of the vessels and heart, and probably in the kidney.

Third Stage.—(1) Toxæmia; (2) organic changes in the walls of the vessels and heart, and probably the kidneys; (3) breaking down of the diseased circulatory apparatus, or symptoms of kidney failure.

The nature of the toxaemia here has been the object of much research, and it is generally recognised now that it is of nitrogenous origin. As Dr. William Russell puts it, the whole problem of hypertonus centres round the three factors of hereditary character, pabulum and excretion. Some individuals inherit vessels which no toxin of alimentary origin scarcely will affect, while others suffer on the least indiscretion. As regards the pabulum, the fault may be in the mere quantity taken, or in the way in which such is dealt with in the alimentary tract. Here certain bodies, known as the aromatic series, are produced in the digestion of the proteins, and these being absorbed, may, either by direct action upon the vessels or in some less direct way, produce vaso-constriction. Normally, the end-products of protein digestion, the amino-acids, are carried to the liver and there changed to ammonia and fatty acids. The ammonia is excreted as urea and the fatty acids are used as energy producers. But in intestinal disorder the amino-acids are attacked by pathological organisms and toxic amines are formed. The diamines are depressors whereas the monamines (or at least one of them) are pressors and raise the blood pressure. The one mentioned corresponds to tyramine (one of the active principles of ergot).¹ These poisons must first pass through the liver, and, if this organ be active, will there be destroyed and so do no harm. Eck's experiment well illustrates this guarding action of the liver. He found that if in animals he tied and divided the portal vein and then connected the lower end with the inferior vena cava, and fed the animals on milk, they would live for some time. But if, on the other hand, they were given even a small quantity of meat, they quickly died from toxaemia. Milk contains protein, of course, but it seems to be specially the proteins of meat, fish and eggs that produce most toxins during digestion. If the toxins reach the general circulation they are chiefly got rid of by the kidneys. Hence is seen the importance of the liver and kidneys in relation to this toxaemia.

Take a man of, say, 45, in whom we find a systolic pressure of perhaps 160 mm. Hg. He seems well, but probably has

¹*Therapeutic Gazette*, Sep., 1920, p. 617.

some increase in the nocturnal amount of urine, which will be too watery and may show a trace of albumen and an occasional hyaline or granular cast. If this patient shows a family tendency to arterial disease, so much the worse. When in such a patient we cut down the animal proteins, putting him chiefly on a lacto-vegetarian diet, cut out excessive smoking and the use of alcohol, and give him some saline every morning, with an occasional mercurial purge, he will probably improve very much and his pressure will come down to normal or nearly so, and, as long as he keeps to these simple rules, may remain so. If such a regimen be not sufficient, regular small doses of potassium iodide may help very much. Stockman showed years ago that this drug had no effect, pharmacologically, in lowering blood-pressure except in enormous doses, but clinically nothing seems to be more evident than its effect in hyperpiesis due to toxæmia. Every clinician has seen its action in relieving the pain in aneurism. The ordinary dose of iodide of potassium is about five grains t.i.d. If it disagree one of the organic preparations of iodine may be used, such as iodipin, which is made by the addition of iodine chloride to oil of sesame.

The treatment so far mentioned is applicable to all cases of arteriosclerosis where the blood-pressure is high, whether the case be early or advanced. But, if, in spite of it, the pressure remains high, and perhaps symptoms of cerebral trouble (such as transient affection of speech or even passing paresis) are showing, then severe purgatives or even bleeding may be required. But the question always arises here whether we should interfere actively with a high pressure merely because it is high,—whether the rise may not be compensatory, and be the best thing possible for the patient under the circumstances. The raised pressure may be due to an endeavour on the part of Nature to overcome an area of anaemia in a vital part of the brain, and may thus be keeping him alive. It is probable that no one rule can be laid down about the care of cases of high pressure beyond those of diet and the other simple ones applicable to the toxæmia.

Moreover, it is wonderful how well many people are with pressures that may at first surprise us, and not only that, but

remain well for years. Especially in stout people, we may find pressures reading over 200 mm. Hg., in whom there are practically no symptoms. When the diastolic pressure is high the outlook is not so good. A man with a systolic pressure of 200 and a diastolic one of 90 is a better "risk" than one with a systolic pressure of 180 and a diastolic one of say 120.

Occasionally, however, we come across cases where the pressure itself is producing some trouble that makes it urgent that we reduce it, and here blood-letting and to a less extent the vaso-dilators may have to be resorted to. As regards venesection, most of us have seen the good results that follow an attack of epistaxis in an arteriosclerotic, and such results are wonderfully lasting. If a normal animal be bled sufficiently, the blood-pressure will fall, but even after as much as half of the total blood of the body is removed, the pressure very soon becomes normal again. It is very different in cases of toxæmia, and the chief cause of the lasting results is probably that by even a very moderate blood-letting we remove toxins that only re-accumulate very slowly. One sees the good effects of bleeding in uræmia, where it is evidently by the removal of toxins that it acts. In regard to the use of venesection in arteriosclerosis, Osler wrote, "In cases that come under observation for the first time with dyspnoea, slight lividity and signs of cardiac insufficiency, venesection is indicated. In some instances, with very high tension, striking relief is afforded by the abstraction of 20 oz. of blood." (*vide* chapter XVIII.)

The Vaso-Dilators are often employed in high blood-pressure and occasionally are of value. Wallace and Ringer¹ have shown that their action is more prolonged here than in normal vessels. One may put them in the following order in regard to their speed of action and evanescence of effect: Amyl Nitrite, Nitroglycerin, *Spiritus Etheris Nitrosi*, Sodium Nitrite, Erythrol Tetranitrate, and last and most lasting, the Nitrate of Mannitol. Edwin Matthew² published some work on the action of the different nitrites in high blood-pressure a few years ago which is interesting. He found that the effect of nitro-

¹*New York Med. Jour.*, 1909.

²*Quarterly Jour. of Medicine*, 1909.

glycerin in 1/100 gr. doses, lasted for about one hour, but a tolerance was quickly established; of sodium nitrite, in two grain doses, for two hours and no tolerance occurs; of erythrol tetranitrate, in $\frac{1}{2}$ gr. doses, for six hours and no tolerance occurs; and of mannitol nitrate, in one grain doses, was even more prolonged and hence was to be preferred. With such drugs it is often possible to keep the pressure down about 30 mm. Hg., and such a reduction may keep the patient comfortable and free from pressing symptoms. It should be noted that tabloids of nitroglycerin and erythrol nitrate are often inert, but solutions of the former and tablets of the latter are likely to be active. Various physical methods are much used for the lowering of high blood-pressure, such as massage and gymnastic exercises, baths, plain or medicated, and static electricity, and they all have their advocates and no doubt are often of some value. Space will not permit of their being discussed here.

To summarize, when we get a patient in the first stage of the disease then he does not require to be treated as a sick man, but still it is necessary to give him a few simple directions as to his way of living in order that he may remain well. He should be urged to live a quieter life in every way. Moderation in all things should be his rule of life. If he be a busy man, and very many of these cases are of the "successful" class, who have lived hard and strenuous lives, then he must be advised to go easier in every way. If his work be of a hard physical kind—it is common to see the condition in farmers—then it must be pointed out to him that he must go on a lower plane if he would reach old age.

When the heart tends to fail here, then, besides treating the arteriosclerosis (or, rather, the associated toxæmia) in every possible way, it may be necessary to use heart tonics. For many years it was taught that digitalis and its allies raised the blood pressure through vasomotor stimulation, and hence were contraindicated when the pressure was already high, but now it has been conclusively shown that digitalis in therapeutic doses has little or no such action and hence it may be freely used when the heart condition suggests its employment. All the same, it is true that in some cases of arterio-

sclerosis, with associated heart failure, it does very much raise the blood-pressure, but it is through its action in restoring the heart.

It is not uncommon to see cases, which, if one may judge from the size of the left ventricle and the state of the arteries, must have had a high pressure, and yet when they come under observation in the third stage, we find the pressure low. Here, if we improve the heart's action by digitalis, then the pressure will rise again. A case of this sort is mentioned on page 203. Strophanthus was specially introduced because, pharmacologically, it was found to have very little vaso-motor effect and yet acted on the heart like digitalis, but it is less used now that this action of digitalis has been shown to be so slight.

ANGINA PECTORIS.—Here there is pain in the cardiac region, often radiating down the left arm and sometimes in other directions, accompanied by a sense of impending death. This sensation is seldom absent here and may be the chief complaint: in fact, a form of angina occurs where pain is absent and the distress is solely of this kind.

The exact nature of angina has been the subject of many theories, but many now agree with Sir Clifford Allbutt¹ that in most instances the condition is associated with disease of the thoracic aorta and that when death occurs it is due to vagal inhibition of the heart. Be this as it may, it is a fact that in the great majority of cases that come to *post mortem* there is found to be more or less narrowing of the coronary arteries from arteriosclerosis. In most instances this is only a part of a general process but occasionally it may be almost confined to the vessels of the heart. Sometimes at *sectio*, we only find disease of the aortic or mitral valves. Angina is assuredly a sign that the heart is unable to do its work, whatever the exact cause of the pain may be. Usually the blood-pressure is high during an attack, but not always, and two classes of the disease have hence been made: (1) those where the pressure is raised and (2) those where the pressure is not high. The former are much more amenable to treatment than are the others.

¹*Lancet*, May 5th, 1923, p. 883.

Diagnosis.—The chief question always to be determined is whether the distress is due to “true angina” or to “false angina.” Often this can be easily settled, but sometimes this is not the case and everyone here makes mistakes. True angina is much more common in men than women. In it the patient generally does not dare to move during a paroxysm and remains more or less rooted to the spot, while in the false type she (for it is commonly a woman) usually walks about and loudly complains. But such rules have numerous exceptions. I recall one man, who paced the floor in his attacks, and yet he shortly afterwards died suddenly in one of them. The state of the blood-pressure, the question of whether an attack is precipitated by exertion or excitement, its relation to meals, all bear on the diagnosis.

As to Treatment—

(1) During a paroxysm the patient will probably be loath to move and absolute rest is most essential. There should be no excitement or visits of anxious friends. Hot applications over the precordium are of value, and hot drinks will often be comforting.

The terrible pain and distress can usually be relieved by bringing down the blood-pressure, and the quickest way of doing this is by the inhalation of amyl nitrite, of which 3-5 minims may be given and repeated if required. The nitrites often help even those cases in which the blood-pressure is not high: the heart at the moment cannot even stand a normal pressure. Strangely enough, sometimes after the fall in blood-pressure following the use of some nitrite, it may rise higher than it was before and yet the pain may not return. Occasionally a whiff of chloroform may give relief. Sometimes the pain is not relieved by the nitrites or other remedies, and then morphia should be freely given.

(2) Between the attacks. Now we have time to go fully into the case and endeavour to find out the special cause that will bring on a paroxysm in an individual case. And here we frequently see that what will precipitate a paroxysm in one person may not do so in another who has his own special *bête noire*.

Environment.—The patient must, as in arteriosclerosis, live a quiet easy life, and here he has an indicator in his tendency to pain that will at once tell him when he is doing too much. Unfortunately, it is just these cases of angina who are so keen on work, both mental and physical, and hence they specially feel their limitations. Some can ride comfortably, although they cannot walk without pain. Exertion after a meal is specially apt to bring on the trouble. Cold keen air also may do so. By living an easy restful life, many of these anginous patients may last for years, and it is not uncommon to see the attacks become less and, even, if due care be maintained, disappear. This is specially so when the first paroxysms have occurred while the patient has been undergoing some unusually severe physical or mental strain. Allbutt urges the value of complete rest for a time, the case being treated much as we would treat one of thoracic aneurism. The patient should be assured as much as possible, and it can be mentioned that the famous John Hunter lived for twenty years after his first attack and then only died during a fit of excitement.

Diet.—The diet here is that of arteriosclerosis, with special care about any exertion after meals, which should be small in bulk.

Specific Treatment.—Occasionally we may see a case that occurs in a syphilitic completely relieved by anti-syphilitic treatment. This is specially apt to occur in those patients under the age of forty. Ehrlich warned against the use of salvarsan in angina, but if one commences with small doses there is little danger.

Symptomatic Treatment.—As already mentioned, any special cause of the attacks, such as high blood-pressure, exertion after meals or excitement of any sort, should as far as possible be avoided. It is well to give iodide of potash in long courses; for example, 5-10 grains t.i.d. for three weeks out of the month. It probably acts as an eliminant. The continuous use of the nitrites is usually not wise, but where attacks are frequent then they may be required. The best ones to employ in that case are the tetranitrate of erythrol or mannitol, each in $\frac{1}{2}$ to 1 gr. doses thrice daily or even more frequently. I

remember some years ago an old practitioner writing to one of the medical journals, telling of how he suffered from frequent anginous attacks and that as long as he took tetrani-trate of erythrol in $1\frac{1}{2}$ grain doses thrice daily he was free of them, and in a quiet way could go on with his work. A year later he wrote again, saying that the drug still kept him free of attacks, only now he had to take double the dose. Then the letters stopped. A friend of mine who suffered in this way always carried triturates of nitroglycerin with him. He was fond of riding and could stand it well, better indeed than walking, but always, as he was mounting, one would see him take a triturate. He had found, as is usually the case, that it was the first exertion that is most likely to bring on an attack. All muscular exertion at first raises the blood pressure and then, as the vessels in the muscles dilate, the pressure tends to fall.

The use of theobromine has been warmly advocated, in doses of 10 to 15 grains thrice daily. It has little effect upon the circulation but causes a good deal of diuresis and probably is helpful on this account.

ANEURISM.—Aneurisms are permanent dilatations of the arteries and presuppose disease of the vessel wall, or traumatism. No healthy artery will permanently dilate under any pressure that it may be subjected to. Aneurisms may occur in any part of the arterial tree, but it is with those in the trunk of the body that we, as physicians, are specially concerned.

While aneurisms are permanent dilatations of the vessels, still, occasionally, it is found that they are spontaneously "cured," and may only be discovered at *post mortem* examination in a patient who has died of something else. The sacculated form is the one that is the most likely to thus become obliterated. This natural tendency to "cure" must be studied, as from it we get a hint as to how we may best proceed. The chief factor that causes an aneurism to dilate, with always the danger of rupture, is the blood-pressure. The factor that makes for "cure" is the clotting of the blood in the sac. Now, clotting does not occur in a normal vessel and it is the disease of the *intima* that causes it here, and any slowing of the blood

current or anything that increases the tendency to coagulation, will help in the process.

No treatment will restore the integrity of the vessel-wall, and all our efforts are with the objects of (1) lowering the blood-pressure, (2) increasing the tendency to clotting in the sac, and (3) relieving the pain and other pressure symptoms.

Environment.—Prolonged rest is here indicated. It acts both by lowering the blood-pressure and in slowing the current and thus increasing the tendency to clotting. Absolute rest for weeks is important, and after that the patient may cautiously get about, always keeping short of any exertion which causes him pain or any discomfort. Sudden strains and excitement of all kinds must be avoided. A man with a thoracic aneurism may sometimes live a fairly comfortable and useful life for some years, and, in fact, as has just been said, occasionally becomes practically cured and eventually dies of something else. But there is always the danger of sudden rupture, and it is well to warn him, or at any rate some one connected with him, that this may occur. It is here, as in any disease where sudden death is at all likely, that we may explain to the sufferer that he is "in the firing line" and, like the soldier there, may escape, but on the other hand may be suddenly struck down. Such, I have found, is a clear and non-terrifying way of putting the matter to the patient. I learned it from a clergyman.

Diet.—This should always be low and of the lacto-vegetarian type, the chief object being to avoid any purins, which are likely to raise the blood-pressure. Alcohol should be excluded, as it tends to excite the circulation. Special "diet cures" have been advocated. Such a one is the Tufnell Diet, which is as follows:—

Breakfast.—2 ozs. of bread and butter, and 2 ozs. of milk or cocoa.

Dinner.—3 oz. of meat, with 2-3 oz. of potatoes or bread, and 4 oz. of water or light wine.

Supper.—2 ozs. of bread and butter, and 2 ozs. of milk or tea.

The patient must be kept absolutely at rest while on this

diet. Of course, it does not contain nearly sufficient calories for even a man at rest nor yet sufficient fluid, but some patients can stand it for several weeks and then often get much relief.

On general principles, fruits should be avoided, as they contain citric acid, which delays the coagulation of the blood.

Specific Treatment.—In the great majority of cases the arterial disease that has brought about the aneurism, is due to syphilis. By the time an aneurism has formed, any anti-syphilitic treatment is too late to do much good to the aneurismal wall. Even if the Wassermann reaction be changed from a positive to a negative one the prognosis is not improved according to T. E. Hess Thaysen,¹ but it will be well all the same to treat the case (where we get a strongly positive Wassermann reaction) as syphilis, in the hope of saving other tissues (see Syphilis). Iodide of potash, especially, will give great symptomatic relief and should always be given in prolonged courses, say 10 grains t.i.d. for three weeks in every month, and in strongly syphilitic cases it may be pushed. It possibly lowers the pressure and there is no doubt about its power of relieving the boring nocturnal pain which is so characteristic of the condition.

Symptomatic Treatment.—Iodide of potash, as just said, is of great value in relieving the pain in aneurism.

In regard to our attempts to increase the coagulability of the blood, we may give calcium lactate, in 10-20 grain doses t.i.d., although, as already pointed out, this has not much effect, unless, indeed, the coagulation-time is already abnormally long. Or we may use gelatine, either by the mouth or subcutaneously (page 256). But there is a much more certain way of increasing the coagulability of the blood than these and one that will at the same time tend to lower the blood-pressure, and that is venesection. The removal of 15 to 20 ozs. of blood from the arm will do no harm and on several occasions I have seen a thoracic aneurism, which could be seen with the fluoroscope to be violently pulsating, become merely a still shadow, suggesting that we had brought about coagulation in it and had thus hastened the natural "cure."

¹*Acta Medica Scandinavica*, Feb. 22nd, 1923, p. 543.

The injection of horse-serum has been tried with the object of hastening coagulation, but I have no experience of it here.

There are various, what one might call, desperate surgical methods of treating these aortic aneurisms which will be mentioned.

(a) Wiring.—A cannula is introduced into the aneurism and many feet of fine platinum-gold wire is passed in through it. The effect of the wire is to cause coagulation around it. Horse-hair, catgut and Florence silk have all been used in this way.

(b) Wiring and electrolysis.—Here, after the wire has been introduced, it is connected with the positive pole of a galvanic current and the circuit is completed by placing a large wet electrode, connected with the negative pole, on the patient's back. The current is commenced at 5 milliampères and is increased every five minutes until 50 milliampères are reached. In 30 to 60 minutes a firm clotting may have occurred about the wire and the current is then disconnected. After this operation the patient must remain perfectly quiet in bed for two to three weeks to favour the consolidation of the clot.

(c) Needling.—A fine needle is passed into the aneurism and the far side of the sac is scratched as extensively as possible. This causes an abraiding of the surface and coagulation tends to occur on it.

Each of these methods has occasionally been followed by brilliant results. J. Sailer¹ specially eulogizes the wiring and electrolysis and gives 17 cases, most of which were benefitted and none injured by the method.

When a thoracic aneurism tends to bulge through the surface of the chest, it will sooner or later rupture. Often for a time the eroded surface will merely "weep" and the tumour should be carefully protected with absorbent cotton. In this way the inevitable end may be postponed for some little time.

PHLEBITIS.—This is a septic inflammation of a vein and is always associated with clotting of the blood in the affected vessel. It is frequently a complication of some local or distant

¹*Therapeutic Gazette*, October, 1921.

septic process, or else of a general infection, such as typhoid fever. The commonest site of the trouble is in one of the femoral veins. As a result, the limb swells and there is a good deal of pain and often some fever.

Treatment.—The limb should be rested, raised and enveloped in absorbent cotton. If the pain be severe it may be considerably eased by smearing the skin over the inflamed vein with a mixture of equal parts of extract of belladonna, ichthyol and glycerine. The object of the rest is to keep the inflamed part quiet and also to lessen the chance of displacement of a clot, which, becoming detached, may form an embolus.

After the inflammation has subsided the limb will for long tend to swell, and should be supported with some form of elastic bandage during the time that the patient is vertical. Crêpe is the best material for this.

CHAPTER XVI.

DISEASES OF THE BLOOD.

ANAEMIA. SPLENIC ANAEMIA. LEUKAEMIA. HODGKIN'S
DISEASE. PURPURA. HAEMOPHILIA.

ANAEMIA.

There are two distinct classes of anaemia and the treatment of the patients is very different in each. These groups are the so-called Secondary and the so-called Primary Anaemias.

(1) The Secondary Anaemias are those in which the condition is due to direct loss of blood or to destruction of it by some infection or toxaemia. Roughly speaking, all anaemias due to some definite cause belong to this class.

(2) To the class of Primary Anaemias belong Chlorosis, Pernicious Anaemia, Leukaemia, and also to them may be added an indeterminate group which includes Hodgkin's Disease, Splenic Anaemia, Chloroma and Infantile Pseudoleukaemic Anaemia.

In most of the primary anaemias the cause is obscure and the treatment consequently indefinite and unsatisfactory.

SECONDARY ANAEMIA.

Diagnosis.—It is generally easy by the use of clinical methods to come to the conclusion that an anaemia is of this type, but a search for the underlying cause must always be made if we can hope to treat the case with success. A diagnosis of "secondary anaemia" is not sufficient, and we should try to get as far as "secondary anaemia due to malaria," for example.

Environment.—All severe anaemias should be kept in bed at first. They will recover more quickly there than if they are allowed to go about. It will be remembered that the nor-

mal haemoglobin is about seven per cent. less at the end of an active day than in the morning, and rest will save some of this loss. In the slighter forms of anaemia, of course, bed is not so necessary.

Diet.—At first the digestion will probably not be very vigorous and one must go carefully with the diet, but the more food that the patient can be got to take without it causing any dyspepsia the better. Red meats are specially valuable here. Tea and coffee should be much limited, as also alcohol and tobacco.

Bitter stomachics are often useful in promoting a better appetite.

Specific Treatment.—Very often it is possible in these secondary anaemias to find and remove the cause and then the blood defect quickly disappears, the red cells increasing more quickly than the haemoglobin. A common cause is the continuous slight loss of blood from bleeding haemorrhoids. It is not uncommon to find a patient who at each daily stool loses a small quantity of blood and he has got so used to this that he scarcely deems it necessary to mention the fact, and yet the continuous drain on him will produce a profound anaemia.

A common cause of anaemia in some countries, particularly in the Southern States, is the continuous loss of blood from hook-worm infection. Here a few doses of thymol may destroy the parasites and then and only then will the anaemia disappear. A malignant growth will produce a severe degree of anaemia and its removal will be followed by recovery of the blood condition. Malaria, chronic sepsis, lead poisoning, will all cause anaemia and must be appropriately treated before this will disappear. In many cases, where the condition has followed some acute infection, the cause has already ceased with the subsidence of the infection, and then all that we need do is to hasten the return to health by appropriate remedies.

Symptomatic Treatment.—The various symptoms of anaemia, such as headache, neuralgia, asthenia, &c., may require special temporary treatment, but our great aim is to get the blood back to its normal condition, and here one drug stands out in great prominence, and that is iron.

Iron.—The use of iron in pale people dates from very early

times, and there is much folk-lore grouped round this metal, and even yet the exact mode of its action in the relief of anaemia is not clearly understood.

It appears to produce its good effects in one of two ways: (1) directly as a food, where it supplies the iron that is wanted in the red cells, and (2) as a stimulant to the red cell production. There are various other hypotheses here, such as that of Bunge, but space will not permit of their discussion.

When iron is taken internally it is absorbed by the upper part of the alimentary tract and largely excreted again by the lower bowel. Hence it does not appear in excess in the urine even when large amounts are administered.

The liver prepares iron for haemoglobin formation and this organ appears to be indifferent as to the form in which the iron reaches it.

There are an enormous number of official preparations of iron, and only the ones most commonly in use will be here mentioned.

(a) Solid Preparations.—(1) *Ferri Sulphas*, dose 1-5 grs.; (2) *Pilula Ferri* (Blaud's pill), which contains the sulphate of iron and potassium carbonate. There is a change takes place and ferrous carbonate is produced. Each five-grain pill yields one grain of this salt. The dose of Blaud's pill is 5-15 grs. t.i.d.; (3) *Ferri Carbonas Saccharatus*. This is a pleasant and mild preparation of iron and is much used with children. The adult dose is 10-30 grs.; (4) *Ferrum Redactum*. This must officially contain at least 80 per cent. of metallic iron. It is a useful preparation and does not seem to be used as much as it deserves. The dose is 1-5 grs. There is an official lozenge of it, each containing one grain of the reduced iron; (5) Finally, we have the three Scale preparations of iron (*Ferri et Quininae Citras*; *Ferri et Ammonii Citras*, and *Ferri et Potassii Tartras* (*Ferrum Tartaratum*), the dose of each of which is 5-10 grs. They are mild and non-astringent and are freely soluble in water.

(b) The most commonly used Fluid Preparations are:—(1) *Tinctura* and *Liquor Ferri Perchloridi*. Dose of each is 5-15 mins.; (2) *Syrupus Ferri Phosphatis*. Dose $\frac{1}{2}$ -1 drachm; (3) *Syrupus Ferri Phosphatis cum Quinina et Strychnina*.

(Easton's). Dose $\frac{1}{2}$ -1 drachm. (Each drachm contains $\frac{1}{32}$ gr. of strychnine); (4) *Syrupus Ferri Iodidi*. Dose $\frac{1}{2}$ -1 drachm.

When iron is being given it is best to administer it after meals. The bowels should be kept free from constipation while it is being taken. All iron preparations, but especially the astringent ones, like the perchloride, tend to constipate from the formation of the black sulphide. If any of the astringent forms of iron are prescribed with vegetable preparations containing tannin, a black precipitate of tannate of iron comes down and is very unsightly. Iron produces headache in some people. This can often be avoided by changing the form in which it is given and by keeping the bowels open during the course.

Iron is usually given by the mouth, but may be used intramuscularly. The citrate can thus be given, in doses of 2-5 grs. dissolved in water and repeated every second day.

There is one type of primary anaemia, in which iron is of great value and that is chlorosis. Here, as will be mentioned later, it acts almost as a specific.

Arsenic is often used in the treatment of secondary anaemia, generally combined with some iron, but it is in the primary types that it is most useful and it will be discussed under that heading.

In severe secondary anaemia that results from haemorrhage transfusion of blood (*q. v.*) is invaluable.

PRIMARY ANAEMIAS.

CHLOROSIS.

This very common form of anaemia practically always occurs in young women. The chief change in the blood is the lowering of the haemoglobin-percentage, while the red cells are not much if at all reduced in number. The result is that the colour-index is very low. There is little change in the leucocyte count, but there is an increase in the bulk of the blood plasma.

The essential cause of the disease is not known, but the want of fresh air and sunlight, constipation, and over-indul-

gence in tea, all seem to tend to precipitate the condition, and hence, probably, its commonness among domestic servants. The patients are usually well-nourished, but are pale and breathless and there may be some oedema.

Environment.—It is very necessary here to keep the patient in bed at the commencement of treatment, and all our efforts are frequently of no avail unless they are accompanied at first by complete rest in bed.

Later on, fresh air and sunshine, and gentle exercise, are valuable, and finally a change of air is often useful to complete the recovery.

These chlorotic patients show many nervous symptoms due to their condition; and their apathy, petulance and irritability often call for much judicious care on the part of the attendants. The psychical condition improves with that of the blood. This psychic state is usually the result of the chlorosis, but in some instances may be at least the precipitating cause. Affairs of the heart are usually at the bottom of the trouble here.

Diet.—These patients require feeding up, especially with fats and proteins; and yet, at first, this is often hard to accomplish, owing to the anorexia and even nausea. Here the bitter stomachics, such as quassia and calumba, given before meals, may help.

Specific Treatment.—As already said, we do not know the essential cause of the ailment, and hence cannot remove it, but we can get rid of many of the predisposing and precipitating influences as above mentioned, and this should be attended to before one goes on to the mere treatment of symptoms.

Symptomatic Treatment.—It is well to begin the course of treatment with a laxative iron mixture, such as the following:

R	Ferri Sulphatis	gr. ij
	Magnesii Sulphatis	5 ss
	Acidi Sulphurici Diluti	
	Glycerini	āā min. x
	Aquae Chloroformi.	ad 5 ss

Sig. This amount three times daily in water after meals.

Then, after a week or so of this, to change to Blaud's pills,

commencing with one t.i.d. and increasing by one a day until the patient is taking nine in the 24 hours. It is usually well to combine a little arsenic with the pills, say 1/100 gr. of the arsenious acid with each. The bowels should be kept gently open with some mild laxative if required.

The iron should be continued until the haemoglobin is up to the normal, which, by the way, is nearer 85 per cent. than 100 per cent. in women. The percentage varies considerably even in normal individuals and depends also upon the method by which it is estimated. In cases where iron disturbs the digestion it may be given intramuscularly as the citrate, say 3 grains every second day. Aseptic ampoules of this are supplied by many drug firms.

It is often necessary for these patients to take iron in smaller doses for months after they have recovered, in order to prevent a relapse. The frequent amenorrhoea which accompanies chlorosis will tend to disappear as the blood improves. It does not require any special treatment, and, in fact, is, in a way, a good thing as long as the patient is anaemic, as she is not now well able to stand the monthly loss of blood.

PERNICIOUS ANAEMIA.

In this type of bloodlessness there is a paucity of red cells and haemoglobin, but the loss of red cells is so much greater than that of haemoglobin that each individual cell may contain its full quota of colouring matter, and thus the colour-index may not be lowered, and is, indeed, sometimes above the normal.

The disease is usually one of adult life, and is more common in males than in females. A peculiarly fatal form of the affection is the *aplastic* one, in which there is little evidence of activity of the bone-marrow, and hence few if any nucleated cells appear in the blood.

We do not know the essential cause of pernicious anaemia. The condition is likely to last as long as the patient survives, but is subject to great variations, the patient suffering from periodical "blood crises," during which the red cell count will

be very low and the symptoms profound. Then, from some unknown cause, the condition will rapidly improve and nothing but a most careful microscopic examination of the blood may show that he has not quite recovered. These natural variations in the course of the disease have often led to many false hopes in regard to different treatments.

If the patient happen to be very bad when put on some treatment and then quickly improves, the practitioner is apt to conclude that his efforts were the cause of the improvement, an example of the *post hoc ergo propter hoc* fallacy, which must so often occur in the treatment of disease.

It is only by the study of large series of cases that conclusions can be drawn as to the effects of any remedial agent used. This has been done here in the case of arsenic, and to a certain extent with blood transfusion, and it is now generally admitted that in these agents we have means by which we can often favourably affect the course of the disease, although we are as yet unable to explain how they act.

Diagnosis.—The diagnosis of pernicious anaemia can only be certainly made by the skilled microscopist, and even then mistakes occur. In most if not in all the cases of believed complete "cures," it is justifiable to doubt if the condition was really of this nature at all.

Environment.—Complete rest in bed during an acute exacerbation is imperative, and between times the patient should live as healthy an open air life as possible. This is often a counsel of perfection. I happen to know of a case of this disease who for years has carried on his work in public life, with occasional pauses during blood crisis; and in 1910 I published a case¹ of a man who had certainly had the disease for twenty years and during most of this time had worked at an indoor employment.

Diet.—During a crisis a pure milk diet is advisable and after that, as much cream, raw eggs and meat, in addition to this, as the patient can comfortably take. Between crises a full diet is indicated.

Specific Treatment.—The removal of the cause is at present beyond our powers, as we do not know what it is, but all pos-

¹*Trans. of the Assn. of Amer. Physicians, 1910.*

sible sources of sepsis or toxaemia should be attended to. Stomatitis and pyorrhoea are common here, and should always be looked for, but the search must include every possible source of trouble.

Symptomatic Treatment.—There is usually a marked *achylia gastrica* present and it is well to give large doses of dilute HCl after meals. Iron is of little value in this condition. The scanty red blood cells are already laden, even to excess with it. The only possible effect that it may have is in its stimulating action upon the red marrow, so that more cells are produced here, but it takes a very secondary place to arsenic in most of the primary anaemias.

Arsenic in some form is the one drug that appears to be of real value here. Experimentally, arsenic does not increase the number of erythroblasts in the bone-marrow, and how it causes a rise in the number of red cells in the blood in pernicious anaemia is quite unknown. Theoretically it may be argued that its well-known lethal effect upon amoebic forms of parasites may have something to do with it; in other words, that it favourably acts because this form of anaemia is due to some such parasite which has as yet eluded detection.

Arsenic is used in the form of the arsenious acid or of the arsenical salts. It is slowly absorbed and slowly excreted. Pharmacologically, the drug is known to lessen the katabolism so that the CO_2 output is lessened as is also the excretion of nitrogen. In this way it tends to cause a gain in weight, and this fact is often shown clinically where a person may gain weight as long as he is taking the drug.

Arsenic improves the nutrition of the tissues, especially those of the skin and nervous system. Gies found that when he gave arsenic to half a litter of rabbits, after a period of four weeks those who had taken it were thirty per cent. heavier than the rest of the litter. Their bones also were longer and thicker, and had undergone changes similar to what occur under the use of phosphorus.

Certain peoples, notably the Styrian peasants, have found that the drug is beneficial in improving their complexion and their physical endurance, and take it habitually in enormous doses.

The chief pharmacological action upon the blood that is noted to occur from arsenic is an increased production in the white blood cells through stimulation of the leucoblastic cells, but in pernicious anaemia it increases the number of red cells in the blood, an action that is normally not present. Perchance, as already said, the arsenic acts as a parasiticide and rather saves the loss of the erythrocytes than stimulates their formation.

The dose of the arsenious acid is $1/60$ to $1/15$ gr. The *Liquor Arsenicalis* (Fowler's solution) is a one per cent. solution of the acid, and the dose is 2-8 mins., but much larger amounts than this may be cautiously reached in some cases. The *Liquor Arsenici Hydrochloricus* is an acid solution of the same strength and dose. The *Liquor Arsenici et Hydrargyri Iodidi* (Donovan's solution) contains one grain each of Iodide of Arsenic and Iodide of Mercury in 100 mins., and the dose is 5-20 minims. It is especially used in chronic syphilitic skin lesions.

In pernicious anaemia the arsenic, preferably in the form of Fowler's solution, should be commenced in moderate doses and gradually pushed until we are forced to stop on account of some physiological effect.

Toxic symptoms of arsenic are most commonly a puffiness about the eyes with some lacrymation, then a disturbance of the appetite soon followed by nausea and even vomiting, and perhaps diarrhoea. The nervous symptoms are depression, irritability, insomnia and failure of memory, while a peripheral neuritis is not rare. When a patient is taking arsenic it is a good plan to test the knee-jerks regularly and to stop the drug if these tend to disappear. There are various other symptoms of chronic arsenical poisoning, such as skin changes, and renal involvement, but the careful therapist will have stopped the drug long before these occur, unless, indeed, they do so early, owing to an idiosyncrasy.

Children stand arsenic exceptionally well, and can take relatively large doses.

In the last few years Salvarsan and other methyl combinations of arsenic have been much given in the disease, but, as already said, we must be cautious in any conclusions as to

the effects of treatment here. Personally, I have seen several cases improve marvellously after salvarsan and also some that were not affected by it. B. Bramwell¹ records 33.3 per cent. of "temporary complete recoveries" from its use as contrasted with 12.7 per cent. under Fowler's solution.

Cacodylate of sodium is a non-official preparation of arsenic, which contains about 35 per cent of the arsenious acid. The arsenic is here bound up in a complex molecule, and it has been shown that only a small percentage of it is freed in the body and that most of it is eliminated unchanged. The drug has been given in pernicious anaemia intramuscularly in doses of about 2 grs. repeated every two or three days. Atoxyl is another body containing a large percentage of arsenic. It is not often given now, but is of interest because it was the use of it in trypanosome disease that led to the discovery, or rather the synthetic production, of salvarsan. If used, it can be given hypodermically in doses of $\frac{1}{2}$ -1 gr. each day for three weeks and then stopped for one week and the course started again. Given in this way there is little danger from its use and the effects may be good.

Transfusion of Blood.—Occasionally the transfusion of blood is of considerable value in this disease.

(1) On the Continent defibrinated human blood is much used intramuscularly. The quantity given is from 20 to 70 mls., and it is repeated every 5 to 7 days. Here the effect is probably that of a foreign protein.

(2) Intravenous injection of whole human blood has been much practised in this disease, and it usually is followed by temporary benefit. It is important that a proper donor be selected. The blood is either citrated or not. Some surgeons are enthusiastic over this method, but Lichty² in an analysis of 115 cases found that there was no evidence of any prolongation of life or even of prolonged remissions between the blood crises. If one may judge from personal experience, there is certainly great temporary benefit from the procedure. There is much recent evidence that the citrating of the blood lessens its value, making the red cells more fragile amongst other

¹*Brit. Med. Jour.*, 1915, 1, 407.

²*Therapeutic Gazette*, July, 1923, page 490.

things, so the untreated blood should be preferred. It is best to use repeated small transfusions of say 500 c.c. every two or three weeks.

Some practitioners have used various sera here, notably diphtheria antitoxin, either alone or combined with splenic extract, and report improvements after the treatment. The action here must be non-specific and of the nature of "protein shock."

Removal of the spleen has been done very frequently now in cases of pernicious anaemia and in some cases seems to have been of value in prolonging life. It should not be attempted in the aplastic type.

SPLENIC ANAEMIA.

This term is usually used to indicate a group of anaemias in which there is much splenic enlargement without lymphatic involvement. It includes the two types known as Banti's Disease and Gaucher's Splenomegaly.

Diagnosis.—Syphilis, tuberculosis, leukaemia, Hodgkin's disease and pernicious anaemia must all be excluded before a case can be designated as splenic anaemia. The anaemia is of the chlorotic type, in that the haemoglobin-loss exceeds that of the red cells. There is usually a leucopaenia present.

The environment and diet are the same as for all anaemias. Good food and much fresh air are essential.

Radical Treatment.—Splenectomy offers here the best chance of recovery and in some 70 per cent. of cases is followed by complete success. The earlier the operation is done after the diagnosis has been completely made, the easier it will probably be for the surgeon to remove the spleen, as there will not then be so many adhesions. When the condition has gone on to enlargement of the liver and ascites (Banti's disease) the chances are not so good.

W. J. Mayo reports 61 instances of removal of the spleen for this condition, with a mortality of 11.7 per cent. Three of these died from thrombosis of the superior mesenteric and portal veins. All the cases operated upon early recovered and remained well. My own experience is entirely in favour of this treatment.

Symptomatic Treatment.—All haematinics, such as iron and arsenic, may be used here with benefit, and the X-ray will sometimes considerably reduce the size of the spleen, and so may be tried in cases in which for some reason splenectomy is not considered advisable.

Spontaneous haemorrhages are common in this condition and must be checked as rapidly as possible, as they lead to much anaemia.

Acholuric Jaundice should be mentioned here. In this condition there is an enlarged spleen with urobilinuria, and yet little jaundice. There is a peculiar fragility of the red blood cells. The disease is apt to run in families. Haemolysis is the essential feature, and removal of the spleen in most cases has brought about a complete cure.

SPLENIC ANAEMIA OF INFANTS.

Here there is enlargement of the spleen and lymphatic glands, along with a secondary anaemia and a leucocytosis, occurring in infants under two years of age.

Rickets, tuberculosis and congenital syphilis all seem to play some part in the etiology of this condition and should be appropriately treated. A generous diet with a large proportion of fats is indicated, as in rickets, and iron and arsenic are both of value. Splenectomy has been performed here, but the results are not as good as from medicinal and hygienic therapy. To a child of two years one may give citrate of iron in one grain doses intramuscularly on alternate days, or sodium cacodylate in similar amount intramuscularly on alternate days, but Fowler's solution and iron in the form of the saccharated carbonate by the mouth usually are very satisfactory. Most of these cases become permanently arrested under careful treatment, so the prognosis is very good.

LEUKAEMIA.

There are two forms of leukaemia, the Myelogenous and the Lymphatic. The former is nearly always a somewhat chronic disease, while the latter may be either acute or chronic.

In the myelogenous form the spleen is greatly enlarged, while in the lymphatic the lymph glands show some increase in size.

The essential nature of leukaemia is as yet unknown, but there is much to suggest some infection here. The condition has been frequently found in the lower animals.

The disease is characterized by great fluctuations in intensity and with occasional remissions to an almost normal state. These remissions may occur under the influence of intercurrent infections, such as pneumonia or diphtheria, and also after and perhaps from various therapeutic measures.

Diagnosis.—This can only be made with certainty through the microscopic examination of the blood. The diagnosis does not rest merely upon an increase in the number of white blood cells, but rather upon an altered ratio in the percentage of the different forms and also upon the presence of abnormal types of cells. The total number of white cells may not be at all raised, or there may even be a leucopaenia, and yet the altered percentage of different types of cells may show that the disease is present. I recall an acute case of the lymphatic form which was fatal in a few weeks. During the whole course of the disease the daily white blood-counts never showed a higher number than 9,000, but over 90 per cent. of the cells were lymphocytes. In some instances the disease may be fatal in a few days. The erythrocytes are usually low in number and deficient in haemoglobin and this anaemia may be a prominent feature of the case. Haemorrhages, diarrhoea and intercurrent infections are all apt to complicate the condition and often are the direct cause of death.

It is usually easy to come to a diagnosis of the disease and also to say to which type the case belongs, but there are occasional atypical cases where this distinction is difficult, and also mixed forms occur.

We cannot hope to cure a case of leukaemia, and hence it is questionable whether any very active treatment should be used in cases showing no progressive tendency, and in which the splenic enlargement is not excessive. But in all cases there are certain rules as regards environment and diet, etc.,

which will aid in raising the general health of the patient, and should hence be attended to.

Environment.—If the condition be acute or the asthenia considerable, the patient is best kept in bed. In the less severe states this is not necessary, although the patients are soon tired and should take things easily in every way. Sometimes they may be quite energetic. I recall the case of a young woman who was skating when she became suddenly blind in one eye, which turned out to be due to a retinal hæmorrhage, and further examination showed that she had well-advanced myelogenous leukaemia, with an enormous spleen. On general principles, plenty of fresh air and sunlight are indicated.

Diet.—A good nourishing diet is necessary and should contain a high allowance of proteins and ferruginous foods.

Specific Treatment.—In the very acute forms of leukaemia no active treatment is of any avail, but in chronic cases a good deal may be done. The cause of leukaemia being quite unknown, we are unable to attack it, but there are three methods of treatment which temporarily affect the condition so much that we may unconsciously be treating the disease specifically, just as the use of quinine in malaria was a specific, although, until the cause of the fever was discovered, it could only be classed as empirical.

These three methods are (1) the use of the X-rays and of Radium; (2) Benzol, and (3) Arsenic in various forms.

X-ray radiations have a most profound effect upon the white cell-producing tissues of the body. In the normal animal the rays applied over the spleen and the long bones will reduce the number of leucocytes in the blood very greatly, and then the animal is apt to die suddenly with renal symptoms. The reduction is almost entirely in the granular cells, and the lymphocytes are not affected.

When the leukaemia is of the chronic myelogenous type then the X-rays will often cause a great reduction in the size of the spleen, and in the number of the white cells. But the good results are not permanent, and so far all cases recorded seem to have relapsed within a year, and strangely enough the subsequent effect of the radiation in later attacks is not so

likely to produce so great an effect. Several cases have died suddenly just as animals do, so the treatment is not without its risks. If it be decided to try it, then the patient should have treatments about three times weekly and at each sitting the rays are applied chiefly over the spleen, but also over the long bones for five or ten minutes. The blood should be constantly watched during the course of the treatment, and if and when the white cells are reduced to 20,000 it should be stopped, as it will be found that the count tends to fall for several days after its discontinuance. However low the count falls it will still show abnormality in the differential count, although there may be a qualitative improvement here. After the treatment has been stopped, a count should be made at least once a month, and any great rise will suggest the need of further treatment of some kind.

Radium has much the same effect in leukaemia as has the X-ray, and is being used a good deal lately in place of it. It can be applied daily for four or five days, and then, after an interval of six to eight weeks, this procedure may be repeated. Giffin¹ gives details of thirty consecutive cases of myelogenous leukaemia treated by the use of radium over the spleen, with dosage of 50-100 mgms. The splenic area was mapped out in squares and the radium applied over each for two to four hours, with a total exposure of 25-36 hours. The spleen rapidly shrank, the blood picture improved and the general condition of the patient was raised.

Benzol is a powerful leucocytotoxic agent, and in both the normal and abnormal the leucoplastic tissues are inhibited and their functions lessened, and in poisonous doses may be destroyed.

In a favourable case benzol will cause a temporary rise in the leucocytes, followed by a fall, chiefly in the polymorphonuclear cells. The pathological types are lessened and the differential blood count approaches the normal, but never reaches it. The spleen and liver lessen in size and the general condition of the patient improves. It is well to remember that much individual idiosyncrasy exists in regard to benzol, and some patients can stand far more of it than others without any

¹*Boston Med. and Surg. Jour.*, 1917, 11, 686.

ill effects. Gastric irritation, headache, bladder irritability and albuminuria should immediately cause us to stop the drug.

These symptoms are specially apt to occur in walking patients, and hence, during a course of the drug, the patient should be kept strictly in bed. Benzol is best given in gelatine capsules. The initial dose should be 30 mins., then 45 the next day, 60 on the third, 75 on the fourth, and then this maximum dose to be continued daily until the white cells have fallen to 20,000, or any ill-effects cause us to stop the treatment. Dramatic improvement often follows the use of benzol, but it is not without its risks, and if pushed too far may cause a fatal break-down of the blood-forming tissues. On the other hand, if the dose be too small it may merely stimulate these tissues to greater activity, and the case gets worse.

The chronic lymphatic type of leukaemia is not so dramatically influenced by these special treatments.

Arsenic is more used than any other drug in the treatment of leukaemia. In experimental work on healthy animals, arsenic increases the white cell production, and yet when these cells are already too numerous in leukaemia, it tends to decrease them,—an example of *similia similibus curantur*. On the other hand, in normal animals it does not increase the red cells, and yet in pernicious anaemia acts in this way more than any other substance. No doubt, some day we will be able to understand these different effects. In leukaemia as in pernicious anaemia, it must be remembered that the condition tends to undergo rapid changes. I recall a case of myelogenous leukaemia, with an enormous spleen and a blood count of over half a million white cells, who was given one X-ray exposure and the count fell to under 4,000 and the spleen could not be felt. A few months later she relapsed and then a full course of radiation had no effect on the blood-picture. Here the rapid fall probably just *happened* and was not connected with the treatment in any way.

The good effects of arsenic are now so generally admitted that there seems to be no doubt about the results, and the practitioner may count on some temporary improvement in most of his leukaemic patients. The drug should be commenced in doses of five minims thrice daily and then gradually

increased to as much as the patient can stand. Or one may use salvarsan or some similar body in small doses as recommended in pernicious anaemia.

Even if the patient has been subjected to X-ray, radium or benzol treatment, it will be well in his comparatively convalescent condition to give him small doses of arsenic in the hope of lessening the tendency to acute relapses.

Splenectomy has been performed in leukaemia, but the results have not been good and most think that it is here contra-indicated.

HODGKIN'S DISEASE (LYMPHADENOMA.)

Here we have progressive enlargement of groups of lymphatic glands and often of the spleen, with usually some anaemia. There may be an irregular fever. The cause of the disease is quite unknown and the prognosis is grave, few cases surviving more than a few years.

Diagnosis.—This is often for a time difficult, and tuberculosis, malignancy, lymphatic leukaemia and syphilis must all be excluded, and the removal of a portion of an affected gland is often advisable to permit of microscopic examination.

Treatment.—Arsenic in increasing doses appears to favourably modify the condition for a time, and is the drug most usually given, and salvarsan has been reported upon favourably.

The enlargement of the lymph-glands sometimes responds to X-ray or radium for a time, and a few cases have thus been arrested for years, but these should not be used if there is any fever, as they may then do harm. If the masses of glands are large, and especially if they produce pressure symptoms, they may have to be surgically removed. Occasionally such removal seems to be followed by cure, but this is open to doubt. The operation should include the complete removal of the tonsils if these are at all enlarged.

The general condition should be attended to in every possible way, and if necessary iron, and probably always arsenic, are of service. Phosphorus has been recommended by Broad-

bent and others. The dose is 1/100 to 1/20 gr., best given in pill form.

Very few cases of this disease survive more than three years and when the condition is acute it may be quickly fatal.

PURPURA.

Purpura is a symptom rather than a disease. It is evidence of some toxæmia, this being either from infection or of a more definitely chemical nature. Thus, purpura occurs and complicates all manner of infectious invasions, such as measles, cerebro-spinal meningitis (hence the name "spotted fever"), pyæmia, rheumatic fever, syphilis, etc. and always suggests a grave infection. It also may be produced by drugs, such as the iodides, quinine, copaiba and benzol (workers in rubber factories are prone to purpura, due to the benzol that is used as a solvent for the rubber).

The hæmorrhages may be small (petechiae) or large (ecchymoses) or may be into joints or various internal organs, such as the brain, or may be from the bowel.

A number of types are described:—

- (1) Purpura Simplex (Peliosis.)
- (2) Purpura Rheumatica.
- (3) Purpura Hæmorrhagica.
- (4) Henoch's Purpura.

These types depend upon the severity of the bleeding and upon the location in which it occurs.

Diagnosis.—The underlying cause must be searched for, and often can be removed, with complete relief to the patient. The coagulation-time of the blood is delayed and the small vessels, probably the veins, seem defective and tend to give way.

Specific Treatment is seen when we treat syphilis or cerebro-spinal fever or acute rheumatism or when we discontinue some drug which may be the cause.

Symptomatic Treatment.—All agents which tend to increase the coagulability of the blood are useful here. Such are (possibly) calcium lactate in 10 grain doses t.i.d., and gelatine,

subcutaneously or by the mouth. In the former method one can give 7 grains of gelatine dissolved in $1\frac{1}{2}$ ounces of distilled water. Horse serum or defibrinated blood are useful. Also whole human blood in intravenous dose of $\frac{1}{2}$ ounce.

The blood platelets in purpura are deficient in number and some of the newer coagulants, such as coagulen, are of value in the haemorrhages. This may be given intravenously in doses of $\frac{1}{2}$ to $\frac{3}{4}$ ounce of a five per cent. solution, or more safely subcutaneously (5 gm. in 300 mls of normal saline solution).

When the bleeding is from some reachable point, local pressure and astringents should be used in addition to these general measures. During a haemorrhage the patient must be kept absolutely at rest.

HAEMOPHILIA. (HAEMORRHAGIC DIATHESIS).

This condition is almost confined to the male sex, and is nearly always transmitted by the female. It is generally a family disease, but may, in rare instances, arise spontaneously. It is characterized by a tendency to easy bleeding, so that any slight wound may be the source of serious haemorrhage, or such may even occur spontaneously. There is great prolongation of the coagulation-time of the blood, which has been variously explained, but seems due to a reduction in the prothrombin content.

Diagnosis.—"Bleeders" usually know of their family failing, and will warn a surgeon or dentist in case of a proposed operation. The diagnosis between haemophilia and purpura is easily made by various blood tests.

Environment.—The sufferers from this condition must avoid any sources of cutting, injury or bruising as far as possible. The tendency to bleeding in them lessens as years advance, and when death occurs from haemorrhage it is usually in early life. The question of the marriage of haemophiles may come up. The females of such a family should be warned of the risk of transmitting the disease to their sons. A non-haemorrhagic male of bleeder stock is not likely to so transmit the condition, although this has occurred.

Diet.—Theoretically, the avoidance of citric acid-containing fruits is advisable.

Specific and Symptomatic Treatment.—The tendency to bleeding may be lessened by calcium lactate, taken in doses of 10 grs. t.i.d. In local haemorrhages pressure and the use of 1-1,000 adrenalin solution are of assistance. The use of various sera, of which that of human blood is the best, is attended with good results. The serum selected may be used locally as a compress or may be given subcutaneously or intramuscularly, or best of all, intravenously: 2 to 6 drachms every 24 hours is usually sufficient. Or gelatine can be taken internally as a jelly or given subcutaneously (7 grs. dissolved in distilled water).

In severe haemorrhage the transfusion of whole blood, taken from a carefully selected donor, is most likely to be effectual.

CHAPTER XVII.

THE THERAPEUTIC USE OF OXYGEN.

Oxygen has been used as an inhalant occasionally for many years but its efficacy has always been doubted by many, chiefly on the theoretical grounds that as the oxyhaemoglobin of the blood is already nearly saturated, no increase in this can be obtained by the mere raising of the percentage of oxygen in the inhaled air. A further objection has been urged that the oxygen may act as an irritant to the respiratory passages. It may be as well to dispose of this objection at once. It is quite true that if animals be placed for a short time in an atmosphere which contains three atmosphere pressures of oxygen they soon contract pneumonia, and, further, Lorrain Smith has shown that this also occurs if animals are kept for several days in an atmosphere of pure oxygen; but it has also been shown that an atmosphere of pure oxygen can be breathed for many hours without any evil effects, and also that an atmosphere containing under 70 per cent. of oxygen can be breathed with impunity for any length of time. Thus we need have no fear that in giving inhalations of oxygen for ten to fifteen minutes at a time, we are running any danger of causing irritation of the air passages.

In recent years much work has been done on oxygen by such men as Haldane and Leonard Hill on the physiological side, and clinically its value has been greatly enhanced by the experience of the War. In the acute respiratory inflammations produced by enemy gas, nothing proved so useful in giving relief as did oxygen. Recently the late Dr. Meltzer, of the Rockefeller Institute, wrote strongly urging its value in pneumonia. Using a special apparatus, which I will presently describe, he showed that such cases may not only be symptomatically relieved, but life may be saved in some apparently hopeless instances.

Looking first of all at the physiological side of the question, it is undoubtedly true that when a healthy individual is breathing quietly the percentage of oxygen in ordinary air (about 20 per cent.) is not only enough to sufficiently saturate

his haemoglobin and to supply the needed partial oxygen pressure in his blood plasma (which is about one-fortieth of that of the haemoglobin), but the percentage of oxygen in the inhaled air may be reduced to perhaps 14 per cent. without causing any distress to the person. In other words, the atmosphere contains a higher percentage of oxygen than is required for the needs of the healthy resting individual. But let that individual exert himself, and soon he will become breathless, and then it is found that an increasing of the oxygen content of the air will help him. This has been abundantly proved by Leonard Hill and others who have shown that a man can do more physical work without distress if he is breathing an atmosphere artificially enriched with oxygen than if he is depending upon the ordinary air. Evidently the difference between the 14 per cent., which is all the oxygen that a man at rest requires, and the 20 per cent. of the ordinary air is, as Meltzer put it, a "factor of safety," and while this factor of safety is sufficient for meeting the increased demands of ordinary exertion, it is not enough for emergencies. A man suffering from some interference with his respiration may be likened to the healthy one undergoing extra exertion.

Further, at high altitudes the partial pressure of oxygen may be less than that of an atmosphere containing only perhaps 14 per cent. of oxygen, and here there is no margin of safety, and the least exertion may bring on symptoms of want of oxygen (often very suddenly), and, of course, if a still higher altitude is attained, as is often done by airmen, then these symptoms will come on without any exertion.

In the last Mount Everest expedition it was found that the climbers using oxygen could ascend faster and with less distress than the men not so equipped.

Again, it has been found that at altitudes of 6,000 feet and over cases of pneumonia do very badly, this factor of safety being now missing. Haldane says here: "Even in ordinary cases of croupous pneumonia the alveolar oxygen pressure may be a matter of decisive importance. This is clearly shown by the fact that these pneumonias do very badly at high altitudes. At Cripple Creek (altitude, 10,000 feet), in the Rocky Mountains, I found that this was so well recognized

that all cases of pneumonia were put on the train and sent down to the prairie level.”¹

Dr. H. L. Crane recently writes to me from Peru as follows: “The altitude of this city is 14,225 feet above the sea level. . . . Pulmonary troubles are very fatal if treated up here. It has been the practice to send all cases of pneumonia down the hill to sea level as soon as possible after they are found and recognized. There is on hand in all the camps at all times a plentiful supply of oxygen, and the common inhaler or respirator with which to give same. The oxygen is used in all cases needing it, and let me say, there are very few cases that if they remain long enough to be recognized as pneumonia do not need oxygen, and badly at that, long before they get over the high point on the trip down the hill. I have repeatedly seen cases get better at once almost as if by magic as the descent is made.”

Oxygen is very essential to the living tissues. As a leader writer in the *British Medical Journal* says, “A man may go for weeks without food, for days without water, but for seconds without oxygen.”²

Anoxaemia is the term applied by Haldane to “the condition when the rate of supply of oxygen is insufficient for the normal carrying on of life.” The causes of it are four: (1) defective saturation of the arterial blood with oxygen; (2) slowing of the circulation; (3) defective proportion of available haemoglobin in the blood; (4) an alteration of the dissociation curve of the oxyhaemoglobin, so that this gives off its oxygen less easily than usual.

Most of these causes are evident. For example, any decrease in the oxygen pressure in the inspired air, or any interference with the passage of air to the blood from outside, will produce a defective saturation of the arterial blood with oxygen, as will also any increased using up of the arterial oxygen if a new supply be not immediately available.

Slowing of the circulation will tend to anoxaemia both by allowing the blood to dwell too long in contact with the tissues and also by delaying its return to the lungs for recharging.

¹*British Med. Jour.*, Feb. 10, 1917, p. 182.

²*British Med. Jour.*, July 19, 1919, p. 81.

Anaemia means a want of haemoglobin in the blood, and poisoning with carbonic oxide gas, and with arseniuretted hydrogen will prevent the carrying of oxygen by the haemoglobin, in the first instance by the CO combining with the haemoglobin and in the second by destruction of this.

The alteration of the dissociation curve of the oxyhaemoglobin is a less evident cause of anoxaemia. Bohr, of Copenhagen, showed that if the carbonic acid in the blood be lowered, the haemoglobin tends to cling to its contained oxygen, and thus the peculiar condition may exist of an anoxaemia with the haemoglobin laden with oxygen which it will not part with.

As regards the relation of anoxaemia to cyanosis it may be said that cyanosis always means anoxaemia (the haemoglobin being more or less in the form of reduced rather than oxyhaemoglobin); but while anoxaemia is generally accompanied by cyanosis, this is not necessarily the case; for example, in carbonic-oxide poisoning the blood is cherry red, and yet the patient may die of want of oxygen. Again, when the carbonic acid is deficient, the tissues may be suffering from anoxaemia, and yet the blood may be red with haemoglobin, which will not part with its oxygen (according to Bohr's Law) because of the lowness of the CO_2 .

Respiration depends upon two main factors: (1) the presence of sufficient CO_2 in the blood, and (2) a want of oxygen. Normally the CO_2 in the alveolar air of the lungs is about 5.6 per cent. of this air, and the least rise in this percentage causes such a stimulation of respiration that the percentage is quickly reduced. On the other hand, a slight fall causes the condition of apnoea, and then in consequence the percentage quickly rises again. The CO_2 acts through the blood by stimulating the respiratory centre.

The effects of fluctuations in the percentage of oxygen in the alveolar air are not nearly so great. Want of oxygen does cause increased breathing, but only to a slight extent. It is possible for a person to be blue from want of oxygen and yet have no increase in respiration if the CO_2 be lower than it should be. But the respiratory centre consists of cells which require oxygen for their proper function, just as do all the

cells of the body, and when the oxygen in the inspired air is sufficiently reduced the respiration becomes weak and then fails. As Haldane says, "One of the most important effects of prolonged or extreme anoxaemia is a temporary partial failure of the respiratory centre, so that oxygen or even artificial respiration may be required for many hours."

I have seen this fact beautifully demonstrated by Professor Macleod in the physiological department of our University, where the tracing of the respiratory movements of an animal deprived of oxygen shows gradual failure which quickly disappears when oxygen is again administered.

It is well to remember that after all it is the amount of oxygen in the blood plasma that really counts. Usually this is only about one-fortieth as much as is contained in the haemoglobin, but as it is used up in the tissues it is constantly replaced from the red cells. Normally, 100 c.c. of plasma contains only about 0.35 c.c. of oxygen in solution, the balance of the oxygen in the blood being combined with the haemoglobin; but it is possible by increasing the oxygen in the inspired air sufficiently to raise the oxygen in solution in the plasma to nearly 3 c.c. per 100 c.c. For example, if the oxygen in the alveolar air be raised to 36.4 per cent., that in the plasma will stand at 0.945 per cent., and if the alveolar oxygen be 86.7 per cent. that in the plasma will be 2.26 per cent. This is always assuming that the pulmonary epithelium is passive. Thus it is possible to increase the partial oxygen pressure in the plasma some seven times by merely raising the percentage of oxygen in the inspired air. After all, the red cells are merely carriers, and it is the oxygen in the plasma that directly feeds the tissues. "One well-known proof of this consists in replacing the blood in a frog with physiological saline and then subjecting the frog with the saline in its blood vessels to an atmosphere of pure oxygen, when it will be found that the animal continues to absorb the normal amount of oxygen and exhale the normal amount of CO_2 . It respire normally without any blood in the blood vessels."¹ The plasma, like travellers during a strike of railway porters, may to a certain extent do its own carrying.

¹*Macleod's Physiology*, p 378.

The effect of anoxaemia on the vital tissues is drastic. If the oxygen pressure be low enough then these tissues quickly die; but short of this they may be fatally damaged, as is seen when after CO poisoning an individual may die, although all the CO in the alveolar air has again been replaced with oxygen. It is thus important to remember that anoxaemia, which clinically is usually shown by cyanosis, is a damaging condition, especially to the nervous and circulatory tissues, and hence should be relieved as quickly as possible, not only for the immediate relief given but also for the sake of the future life and health of these tissues. It has been pointed out by Meakins, Priestly and Haldane¹ that in many cases in which the respiration is shallow but rapid, the patient is insufficiently ventilating his lungs, although breathing a great deal. Here a vicious circle is liable to be established, the anoxaemia making the breathing shallow though rapid, and the shallow breathing increasing the anoxaemia. Rapid breathing may mean a weak heart. Cheyne-Stokes' breathing is a sign of a failing respiratory centre and may usually be at least temporarily removed by inhalations of oxygen.

Thus, from a clinical point of view, whenever a patient is cyanosed and usually whenever he is breathing very rapidly he is more or less in a state of anoxaemia, and we should try to relieve this by increasing the percentage of oxygen in the air that he breathes. Haldane says, "Cyanosis may always be taken as an indication that oxygen inhalation should be considered." There are, of course, two kinds of cyanosis: (1) the leaden colour of the skin often seen in acute respiratory conditions, when the oxyhaemoglobin is reduced, and yet the veins are not too full, and (2) the blue colour of the mucous membranes, in which the veins are distended with this reduced blood. In this latter type venesection is often called for, followed, if necessary, by oxygen.

Methods of Giving Oxygen by Inhalation.—I may say here in parenthesis that oxygen has been administered subcutaneously, intravenously and into the cavities of the body, but we are only now dealing with its use as an inhalant. Perhaps the commonest way of giving oxygen is to hold a funnel connected

¹*Jour. Physiol.*, 1919, lii. 433.

with the oxygen cylinder near to the face of the patient. This is a most unsatisfactory way and scarcely deserves to be considered as oxygen administration at all. Meltzer has shown that it is not thus possible to raise the percentage of oxygen in the inhaled air by more than 2 per cent. Further, in a patient already short of breath the mere holding of a funnel close to his mouth and nose gives him a sensation of smothering and he will often try in his agony to remove the apparatus. I have not used the Haldane apparatus, but it involves the placing of a mask over the patient's face, and hence has this objection, and Haldane himself says that the patient may try to remove it. The same objection applies to the apparatus of Leonard Hill. A much better method than this, and the one that we used most extensively overseas was the giving of the oxygen through a soft rubber tube inserted into one nostril and held in position by a strip of strapping. This is a wasteful way of giving the gas, but very efficient, and the patient does not object. Its efficacy can be greatly increased if an attendant rhythmically closes the opposite nostril during each inspiration. Using this method with Professor Macleod, we found that his alveolar oxygen was raised to over 20 per cent. when the tube was in one nostril, and the other nostril left open, while when the other nostril was rhythmically closed during each inspiration the oxygen in the expired air rose to 59.9 per cent.

A third way of giving oxygen is by the use of the oxygen chamber. I saw this method recently at Cambridge, where Dr. Barcroft and his assistants were experimenting with it. They had three chambers in use. These were made specially for the treatment of late gassed cases, but, as the Armistice had come before many soldiers had been treated, they were continuing the work on other conditions. The oxygen content of the atmosphere in the chamber was maintained at 40 to 50 per cent., any excess of CO_2 and moisture being removed by suitable agents. The patients were kept in the chambers from 5 p.m. until 10 a.m. next day for five consecutive days. Great improvement in their condition was evident by the removal of the nocturnal dyspnoea from which they nearly all suffered, by a greater capacity for physical work during the day and

by the removal of the polycythaemia, which was usually present. Several British hospitals have had such oxygen chambers erected as part of their equipment, notably at Guy's and at Stoke-on-Trent, and hope is held that many patients will be much benefitted by their use.

The last method that I will describe is that of the late Dr. Meltzer. The apparatus consists of a hollow tongue depressor which is placed in the patient's mouth and is connected with a gas bag filled from an oxygen cylinder. A valve is so placed that during inspiration the oxygen under pressure from the elastic walls of the bag enters the patient's fauces, while during expiration the oxygen flow is checked and a large opening appears near the valve through which the patient exhales. This valve is worked rhythmically by the thumb of the operator. By this arrangement the oxygen enters the air-passages under pressure during inspiration, while during expiration no resistance to the breathing occurs. Meltzer says that Dr. A. L. Meyer, of the Rockefeller Institute, found that after he had been thus insufflated for eight minutes his expired air consisted of nearly pure oxygen, the nitrogen of the atmosphere being displaced by this gas. Professor Macleod and I tried this on him, and the analysis of his alveolar air after nine minutes' insufflation showed a percentage of oxygen of 36.4 instead of the normal of 16.5, and when we repeated the experiment, with the nose clamped so that he breathed entirely through the apparatus, the percentage of oxygen in the expired air rose to 86.7 per cent., which practically confirms Dr. Meyer's findings. Now, as before stated, a rise of the oxygen pressure in the alveolar air to 36.4 per cent. means a corresponding rise of oxygen in the plasma to 0.945 per cent., and if the oxygen in the alveolar air stands at 86.7 then that in the plasma will be 2.26, or seven times the normal. The haemoglobin in a healthy man is already nearly saturated with oxygen and will, hence, take up but little more when it is offered to it through the raising of the percentage in the alveolar air. In fact, as already said, the inhalation of oxygen by the resting normal individual produces no results. The pulse-rate, respiration and blood-pressure remain unaltered and the individual has no subjective sensations.

But in anoxaemia, the haemoglobin is not saturated, and in such cases we can not only raise the oxygen percentage in the blood plasma, but also in the red blood cells, and hence the cyanosis tends to disappear.

In the British Medical Journal of March 6th, 1920, Dr. J. C. Meakins states that the arterial blood of the normal individual is nearly 5 per cent. "unsaturated" with oxygen, while in pneumonia the "unsaturation" may amount to nearly 18 per cent. By giving oxygen with the Haldane apparatus he was able to reduce the degree of unsaturation in the normal by one-half and in the pneumonic individual to just over 3 per cent. In other words, by the use of the method, he increased the oxygen content of the blood of the cyanosed pneumonic person to above that of the normal individual. No better evidence than this could be needed of the value of oxygen inhalation in anoxaemia.

Coming now to actual experience in the therapeutic use of oxygen, I think that if it be properly given there is no doubt of its value in suitable cases. I say properly given, for if the administration consists merely in holding a funnel connected with the oxygen tank in front of the patient's face then the result will naturally be *nil*. As already said, in this way one cannot raise the oxygen in the alveolar air by more than 2 per cent., and, further, the patient probably objects to the apparatus, which interferes with his normal breathing. When the oxygen is given by the tube in a nostril great relief can usually be given. During the epidemic of influenza and pneumonia in England last year, I frequently saw military patients, who were breathing badly and cyanosed (even although being treated in the open air), improve visibly in a few minutes under this form of administration. Not only does the cyanosis lessen or disappear and the breathing tend to become slower and deeper, but again and again have I heard the patients express their great satisfaction at the relief given, and in such a definite disease as pneumonia the subjective improvement is of much significance and value. In some cases the cyanosis is relieved and yet the breathing remains rapid, while in others the opposite is the case; but in most instances the cyanosis is lessened and the respiration slows. Thus, in a patient insuf-

flated recently by the Meltzer method the respiration fell from 32 to 18 and the slight cyanosis from which he suffered remained practically unaltered. If the pneumonic patient is having much pleuritic pain he will often say that the oxygen has relieved it. I presume that the slowing of the breathing accounts for this. It may be objected that oxygen insufflation is only symptomatic treatment and that the patient will soon relapse, but very often he may not do so for hours or not at all, and the treatment can always be repeated as required. As Haldane says: "It may be argued that such measures as the administration of oxygen are at the best only palliative, and of no use, since they do not remove the cause of the pathological condition. As a physiologist I cannot agree with this reasoning. The living body is no machine, but constantly tending to maintain or to revert to the normal, and the respite afforded by such measures as the temporary administration of oxygen is not wasted but utilized for recuperation." It is pleasant to see such reliance in the *vis medicatrix Naturae* in such an authority. Meltzer thought that many patients have the power of storing oxygen in their tissues. This is not, I believe, accepted by physiologists, but the fact remains that the improvement after oxygen insufflation is usually very persistent.

It should be mentioned here that it has often been urged that the good effects of oxygen are enhanced if the gas be bubbled through alcohol. A four per cent. vapour can be obtained if the oxygen is passed through absolute, or even 90 per cent., alcohol. With brandy, whisky and other spirits the strength of the vapour is too low to be of any value. In a recent discussion before the Royal Society of Medicine, Dr. W. H. Willcox spoke very highly of the therapeutic value of this method in cases of pneumonia, heart failure and other conditions where oxygen was indicated.

I would urge that oxygen be employed in all serious cases of anoxaemia and that its administration should not be delayed and only used as a *dernier ressort*, but should be employed early, before the vital tissues have been much damaged by the want of this essential gas.

CHAPTER XVIII.

THE PRESENT POSITION OF VENESECTION.

The practice of blood-letting is a very old one. Mention is made of it hundreds of years before Christ: for example, it is spoken of in Homer's *Odyssey*; and Hippocrates, who lived in the fifth century, B.C., used it constantly and laid down certain rules for its employment in pain, inflammation and ardent fever. Galen is stated to have made use of it very frequently. Through all the subsequent centuries bleeding seems to have been employed regularly and in what might be called a rational manner, but towards the end of the eighteenth and beginning of the nineteenth centuries its use became an abuse and reached its climax in the time of the French physician, Broussais and his pupil Bouillard, of whom it was said by their opponents that they shed more blood than did their great general, Napoleon. Then the procedure rather suddenly dropped out of use and for the rest of the century was scarcely employed at all and many practitioners would go through a long life without having ever seen it done.

The history of blood-letting is a good example of extremes in fashion in Medicine. History is full of such examples, and they do not reflect much credit on our art. Marshall Hall, (Dr. Marshall Hall and the decay of Blood-letting), that original and energetic physician, who lived in the early part of last century, gets the credit of having caused venesection to go out of use, and yet, when one reads what he says about it, he must either be misquoted or else it is well shown to what an enormous extent venesection must have been employed about this time. Certainly his advice as to the frequency with which the method should be employed would be considered as very excessive nowadays, and he would be ranked as an ardent advocate rather than as a condemner of the proceeding. He classified all people into three groups as regards their toleration of blood-letting, as follows: (the tolerance was gauged by the amount of blood that could flow before the production of incipient syncope in the sitting posture):

1.—Augmented Tolerance:—

- (a) Congestion of the brain, tendency to apoplexy, apoplexy due to congestion,—40 oz.
- (b) Inflammations of serous membranes: arachnitis; pleuritis; peritonitis; inflammations of the synovial membranes and of the fibrous textures of the joints,—30 to 40 oz.
- (c) Inflammations of the parenchyma of organs: of the substance of the brain; pneumonia; hepatitis; inflammation of the mamma,—30 oz.
- (d) Inflammation of the skin and mucous membranes: erysipelas; bronchitis; dysentery,—16 oz.

2.—Healthy Tolerance:—

This depends upon the age, sex, strength, etc., and on the degree of thickness of the parietes of the heart, and is about 15 oz.

3.—Diminished Tolerance:—

Fevers and eruptive fevers,—12 to 14 oz.; delirium tremens and puerpural delirium,—10 to 12 oz.; laceration and concussion of the brain, and accidents before the establishment of inflammation,—8 to 10 oz.; intestinal irritation, dyspepsia,—8 oz.; cholera,—6 oz.

Marshall Hall ("Cyclopaedia of Practical Medicine") wrote as follows: "General blood-letting is of all our remedies the most powerful; its employment requires the utmost consideration. If we neglect the remedy in cases in which its use is required, we allow the disease to make a dangerous progress." And again: "In cases of inflammation, no one would think of trusting the safety of the patient to any other remedy than blood-letting,"—all this from the man who condemned blood-letting as it was indiscriminately practised in his time! Soon after this, as already said, the remedy went out of fashion. No doubt during the last few thousand years there have been many such fluctuations in the value accredited to the procedure, and after such a chequered career venesection seems to be once more coming into favour—so far, in a restricted way. We can only hope that a method which appears to be of such

great value in certain cases may not be overdone; in fact, that the pendulum may not once more swing too far beyond the sane line.

Physiological Effects of Blood-Letting.—It has been estimated by Haldane and Lorrain Smith (*Kirke's Physiology*) that the blood in a healthy man constitutes about one-twentieth of the total body-weight. In anaemic and some other abnormal conditions, strange to say, it may comprise as much as one-tenth. Thus some diseased people have relatively more blood than have healthy ones, although this, of course, is of poorer quality.

When a moderate quantity of blood is experimentally withdrawn from an animal, the total bulk of remaining blood is restored within a few hours. The corpuscles reach their normal count within a few days, after a preliminary marked leucocytosis. The haemoglobin is more slowly replaced. Here is a case recorded by Dr. J. Earle Ash¹, which well illustrates these facts, which have been shown experimentally. A young woman was admitted to the hospital suffering from a ruptured ectopic gestation, with very severe haemorrhage into the peritoneal cavity. Twenty-four hours after the rupture had occurred the leucocytes numbered 40,000, and eighteen hours later the haemoglobin was twenty-five per cent. and the red blood cells only 825,000. Within a few days the leucocyte count was normal, in about three weeks the red cells had reached their ordinary number, while the haemoglobin was only completely restored at the end of two months. Besides these changes, there has been noted after a profuse haemorrhage a lessened viscosity of the blood, and even after a moderate bleeding the coagulation-time is lessened so that the blood tends to coagulate quickly at the bleeding point—which is, of course, one of Nature's ways of stopping the bleeding. In some work on the coagulation-time of the blood² we found that it was more surely hastened by haemorrhage than by any other means tried.

The amount of blood that can be removed from an animal without causing death is commonly said to be one-half of the

¹*Boston Med. & Surg. Journal*, Dec. 5th, 1912.

²*Trans. Assn. Amer. Physicians*, 1910.

total quantity, but in certain diseased conditions it seems that far more than this may be lost without a fatal issue. Thus, Hayem¹ has stated that as much as one-eighteenth of a patient's body weight may be lost and yet recovery occur. Enormous quantities were removed therapeutically in repeated bleedings a hundred years ago:—thus, for a pleurisy over 5,000 grammes—over 150 ounces—were commonly taken away in a few days. In a case of acute rheumatism² as much as twenty pounds—about 320 ounces—were removed within a few days and the patient, strange to say, recovered.

It has been said that when the erythrocytes are below one million as the result of an acute haemorrhage recovery is impossible, but the case given above shows that this rule does not always hold, as there they numbered only 825,000, and yet the patient had quite recovered in two months.

Therapeutically, bleeding may be of value in several ways:

1. When the right side of the heart and the veins flowing into it are distended with blood from any cause, and the patient is cyanosed and dyspnoeic, the removal of some blood from the veins may be life-saving, and this in a purely mechanical way. This is the simplest manner in which venesection acts and probably most practitioners nowadays have seen the striking results so obtained.

Case 1.—A. B., age seventy, was admitted to the Toronto General Hospital in a semi-conscious state. He was cyanosed and the extremities were blue and cold. He appeared to be dying. Had been ill for several days and was found lying alone in this state, and brought to the hospital. He was at once bled from the arm. At first the blood would scarcely flow, but we eventually took fifteen ounces from him. Within an hour he was much better and examination showed that he was suffering from lobar pneumonia, although he had little fever. Eventually he did well and left the hospital cured. Here failure of the right heart seemed to be the immediate cause of the desperate condition, and, as far as one could judge, he would have died within an hour or two if he had not been thus relieved.

¹*Forchheimer's Therapeutics of Internal Diseases*, III., 671.

²*Ref. Handbk. of Med. Sciences*, II., 71.

It would seem to be most wise in these cases to open a vein near to the heart, such as the jugular. Some have even advocated the direct relief of the right heart by puncture in very desperate cases. Dr. J. Wallace Milne, of Aberdeen, recorded such a case some years ago.¹ His patient, a young woman of twenty, was cyanosed and unconscious. Blood would not flow from either median basilic vein nor from the incised brachial artery. So then he passed a trocar and cannula of the size of a No. 3 catheter directly into the right heart through the fifth left intercostal space, and drew off twenty ounces of blood. The patient recovered consciousness, but died several hours later. Such an operation would probably be justifiable in a few desperate cases and might save life.

In less acute conditions of failure of the right heart with cyanosis, a preliminary bleeding will often cause digitalis to act better than if this drug is given without such a preceding step.

2. As mentioned above, bleeding brings about a quicker clotting of the blood than does any other agent with which we are acquainted. Hence, theoretically, it would seem to be sound practice to bleed when a hæmorrhage is occurring in some deep part, where the presence of the extravasated blood may do harm; for example, in cerebral hæmorrhage. The old practitioners used to bleed for shotgun wounds of the chest in order to stop the deep bleeding. Such a case is mentioned in Blackmore's "Lorna Doone," and Mr. Albert Carless tells me of an officer who was bleeding to death at the Front from a gunshot wound of the chest when he received another wound that opened a large vein in the arm. The further bleeding was followed by a cessation of the hæmoptysis and he eventually recovered.

Because of the fact that bleeding hastens coagulation it would be bad practice to bleed in cerebral thrombosis or embolism; but it might be sound, and indeed is often recommended, to do it in aneurism, where we may thus aid Nature's way of relieving the condition, which is by the production of clotting in the sac. I have done this several times with great symptomatic benefit to the patient.

¹*Lancet*, 1910, II., 377.

3. By far the largest field for blood-letting appears to be for the relief of toxic states, bacterial and other forms. In acute conditions, such as uraemia, in gas poisoning, and in various toxaemias due to infections, such as typhoid fever and pneumonia; and in chronic conditions, such as chronic uraemia and arteriosclerosis, the removal of a moderate quantity of blood from a vein acts in a way which is certainly more striking than results from any other treatment at our command. How this effect is brought about is not very clear. Of course, it is easy to think that the toxins are removed along with the blood, and Ch. Bouchard¹ says here: "It is certain that we remove more extractives from the blood by bleeding than by any other channel, the renal excepted, for a bleeding of 32 c.c. removes from it as much as does 280 c.c. of liquid diarrhoea or 100 litres of perspiration." But when one considers that a moderate venesection of, say, fifteen ounces removes only perhaps one-seventh of the blood of the body in health, and perhaps only one-fourteenth of it in disease, it would seem that the toxins are only a fraction less strong than before, which should not make such a marked difference. But we know that after a bleeding the vessels quickly fill again, and this fluid must all come from the tissues and lymph channels, and thus there is a profound change in the position of much fluid in the tissues. One may safely put the matter in this form at present:—venesection may in toxic conditions bring about a marked amelioration in the state of the patient, but how this change for the better occurs is not very clear, although several theories may partially explain it.

4. The question of immunify is at present keenly interesting the profession, and it would seem that one way at least in which bleeding relieves patients suffering from infections is by its stimulating the production of antibodies. Much evidence has been accumulated in the last twenty years to show that haemorrhage tends to increase the natural immunity to infection by bringing about in some obscure way an increase in the antitoxins and antibodies. Roux and Vaillard², in 1893,

¹*Lectures on Auto-intoxication in Diseases.*

²*Brit. Med. Jour.*, 1910, I., 104.

showed this to be the case by experiments on animals, and recently the same experimental proof has been given in the case of man. Professor Dreyer and Dr. Schroeder, of Copenhagen, showed some years ago that bleeding produced an increase in the agglutinins, both in man and animals suffering from typhoid fever, paratyphoid, and in *bacillus coli* infections. Dr. Schroeder then cautiously asks, "if it is not possible that this augmented production of agglutinins and presumably other antibodies as well, may not furnish in part at least the correct explanation of the beneficial effects that have been ascribed from time immemorial to the letting of blood in acute disorders?" Thus is a time-honoured empirical method brought into line with the latest theories.

The following case is one of lobar pneumonia in which timely venesection appeared to save life by the relief of toxæmia.

Case II.—Man, aged twenty-seven, carter, admitted to the Toronto General Hospital very ill with double pneumonia. Was flushed, cyanosed and quite unconscious. Three days later we thought that he could not last many hours. He was flushed and cyanosed, unconscious and dyspnoeic; tongue dry and like sand-paper; systolic blood pressure 135. We bled him, removing seventeen ounces of blood from the median basilic vein. Pressure fell to 110 mm. By night he was much easier, fever less, and was conscious, with a more natural color. Next day the fever was high, but patient never became so ill again, and at last on the eighth or ninth day of the disease had his crisis, and eventually completely recovered. In this case death was threatening from toxæmia.

The relief of toxæmia in acute infections by bleeding is further discussed under the heading of typhoid fever. In many such cases after a severe bleeding the patient can be transfused with advantage.

All have seen the benefit of blood letting in uræmia.

In chronic toxæmias a bleeding often appears to be of value. Probably all have occasionally seen the good effects of a nose-bleeding.

The following case impressed me some years ago.

Case III.—H. L., aged sixty-five, a hard working indigo planter in India, suffered from pains in the chest and feelings of faintness, although the pulse was always too hard and strong. Irritable and sleepless. Various treatments were tried for the arteriosclerosis without much effect. One evening, while driving, he was seized with faintness and soon after vomited a large quantity of blood. Was weak after this for a time, but then picked up and the improvement in his general condition was very marked. A year later he began to be troubled with pains in the chest and upper part of the abdomen again. The pulse was strong and of high tension. I was suspicious of a dilated aorta. He went home to England and a year or two later had a stroke, and this recurred and proved fatal. In this instance the haemorrhage made “a new man” of the patient for fully a year, and on looking back on the case I feel confident that a timely venesection, repeated perhaps twice yearly, might have kept him in comparative health for some years.

It is remarkable, in these cases, how long the good effect of venesection remains. R. F. Fox¹ in an article entitled “Cases illustrating the use of Venesection,” gives many examples illustrating this fact. For instance, he speaks of a lady of gouty habit who had had precordial pain, and heat and pain in the head with subconjunctival haemorrhages and vertigo, which he diagnosed as one of “post-menopausal congestion, threatening apoplexy.” He bled her to the extent of fifteen ounces, and four years later she wrote that the “bleeding had done her a great deal of good,” and that the vertigo had not returned.

Methods of Venesection:—The old practitioners used to bleed by cutting the skin and vein at one incision, but nowadays it seems safer to expose the vein by an incision right over it, and then incise it by a second cut. I find it is much easier to do this if the vein is picked up with a fine pair of forceps. No stitches are necessary. Recently a method has been used which is neater and cleaner. It consists in puncturing the vein through the skin with a sharp needle of 2 mm. diameter, which is best directed downwards against the cur-

¹*Lancet*, 1911, II., 1067.

rent. The blood flows freely through this, and if a piece of tubing, previously filled with water, be attached to the needle and this be led into a vessel, then as much negative pressure may be used as desired and thus the chances of clotting in the needle are lessened. It is well to sterilize the needle by boiling it in liquid paraffin as this lessens the tendency of the blood to clot in its lumen.

Small amounts of blood can be removed and local congestions relieved by the use of leeches or by wet-cupping.

Conclusions:—In many cases venesection is the most powerful method of treatment at our command, and, if used with discretion, seems to be free from any bad effects. It is often indicated in the following cases:—

- (a) Heart failure, acute or chronic, with much cyanosis.
- (b) Acute toxaemias, such as acute uraemia.
- (c) Acute infections, such as typhoid fever and pneumonia.
- (d) Chronic toxaemias, especially those with high blood pressure.
- (e) It may be occasionally used in cases where we wish to increase the coagulability of the blood, as in deep haemorrhages, and in aneurism.

CHAPTER XIX.

DISORDERS OF THE DUCTLESS GLANDS.

OPOTHERAPY.

It is now known that many of the organs of the body produce secretions, which are poured into the blood and carried over the body to other organs, and produce certain effects there. Such secretions have been termed by Schäfer "autacoids." These substances are not enzymes but of far simpler chemical composition. They are dialyzable and are not destroyed by heat. Most of them stimulate the functions of the tissues and such are called Hormones, while a few depress function and these are termed Chalone. It is only the former that at present have any bearing on therapeutics.

Internal secretions (autacoids) have been found, or at least suspected, in connection with nearly every organ in the body, and most of them have been carried into the sphere of treatment, often on very insufficient grounds. So far, only four of them are proved to be of undoubted therapeutic value: these are those of the adrenal, the thyroid and the pituitary glands, and lastly the islands of Langerhans in the pancreas. Possibly one might add ovarian secretion as a fifth.

While autacoids act chiefly specifically on special organs, they have often a very wide-spread and sometimes obscure influence upon the whole body economy but our knowledge of them is still in its infancy, and the subject of opotherapy must be frequently rewritten if it is to be at all up to date. In some quarters the use of glandular extracts has gone far beyond any scientific support, and, as Swale Vincent¹ has stated in a recent very sound address, "constitutes one of the worst forms of present day quackery," and A. J. Clark² well adds that "endocrine therapy is coming to bear a suspicious resemblance to mediaeval magic."

It is being more and more realized that disturbances in certain functions of the body may be due to *qualitative* rather than quantitative changes in hormones.

¹*Lancet*, Aug. 12th, 1923, p. 313.

²*Brit. Med. Jour.*, July 14th, 1923, page 51.

SUPRARENAL CAPSULES.

ADRENAL INSUFFICIENCY. ADDISON'S DISEASE.

The suprarenal bodies are occasionally the seat of organic disease, and when they are destroyed their absence brings about a certain train of symptoms which were first described by Addison. These consist in progressive asthenia, low blood-pressure, low temperature and a frequent peculiar patchy pigmentation of the skin and mucous membranes. The cause of Addison's disease is nearly always tuberculosis, but occasionally other conditions may equally destroy the organs, syphilis being here specially mentioned, as we have a specific treatment for it. In rare instances no lesion of the glands is found, but, instead, involvement of the semilunar ganglia. If the suprarenals be completely destroyed death quickly ensues, but short of this we find all degrees of adrenal insufficiency (*hypoadrenia*), many of which are temporary and due to various acute general infections, such as typhoid fever, or to nervous strain where the glands are apparently suffering from exhaustion following overfunction. Here the temporary use of suprarenal extract is often very valuable. Even in true Addison's disease great fluctuations occur in the course of the case, which makes it difficult to judge of the value of any special treatment.

In all cases where symptoms are present which suggest a want of suprarenal secretion in the blood, it would seem rational for us to attempt to supply this by administration, as we can so successfully do in the case of thyroid insufficiency, but although this can often be partially done the results are not nearly as brilliant as in hypothyroidia. Adam's analysis of 112 cases of Addison's disease treated by suprarenal medication shows that 5.35 per cent. were permanently benefitted or cured, 29.5 per cent. showed much improvement, 43.75 per cent. showed no effect and in 6.25 per cent. symptoms of an alarming character occurred.

In the slighter degrees of insufficiency one can hope for better results than these, but it must always be remembered that the functions of the adrenal bodies are as yet not clear and most authorities have now altogether abandoned the view

that adrenin has anything to do with the maintenance of the normal blood pressure.

Attempts have been made to implant grafts of suprarenal tissue into the bodies of these patients but the results have not been encouraging, although a few successful cases seem to have occurred. Such a proceeding can certainly not be considered as being in more than the experimental stage.

The only B. P. preparations of suprarenal gland are the *Adrenalinum* itself and the *Liquor Adrenalini Chloridi*, which is a 1-1000 solution. The American Pharmacopoeia has also a dried extract, which represents about six times its weight of fresh sheep's gland. The dose of this by the mouth is 2-5 grains and of the solution of adrenalin 10-30 minims. When suprarenal gland or the adrenalin are given by the mouth, very little effect is seen on the blood-pressure, but nevertheless it seems to be of some value in cases of adrenal insufficiency, and, as stated, may occasionally bring about an apparent cure. The usual dose of the dried extract is 2 grains t.i.d. That the drug can be taken by the mouth with little general effect is shown by a case where a man swallowed 35 c.c. of the 1-1000 adrenalin solution without appreciable result. When the solution is given hypodermically the general effects are still slight: when given intramuscularly they are more evident, and when it is injected into a vein, are very great and at times even alarming. These effects have been shown to be very much like those produced by any stimulation of the sympathetic nerves, and the action is really brought about by an indirect stimulation of the terminations of these nerves in the tissues of the various organs.

Thus, there is vaso-motor constriction with a rise in arterial blood-pressure. The arterioles are not all equally affected by adrenalin: those of the splanchnic area are most sensitive to it, those of the lungs and cerebrum very little so, while the coronary arteries do not respond at all. The action depends upon the amount of muscle tissue in the vessel walls and the extent of nerve supply to them. A synthetic adrenalin has been made by various firms which has much the same effect as the natural product but in the case of at least one of them (epinine) we found the peculiar difference, that

while the natural substance raises the systolic blood-pressure it lowers the diastolic pressure, but epinine raises both.

Stimulation of the sympathetic nerves should hasten the action of the heart, but, owing to increased vagal action from the increased blood-pressure, this organ is usually slowed, unless indeed the vagi be weakened by atropine or some other cause, in which case the heart responds to sympathetic stimulation and becomes hastened. As a result of the two influences the heart, after an average dose, is first hastened, then slowed and finally again hastened.

Intestinal peristalsis is inhibited, but the sphincters of the pyloric and ileo-caecal valves are contracted. The effect upon the uterus varies in the pregnant and the non-pregnant organ in some animals. In others, as in the dog, contraction always occurs and this is the case in the human subject.

The action of adrenalin on the bronchial muscles is as a rule inhibitory and thus is explained the good effects of its use in asthma, but it has been recently shown by Gottlieb & Bullowa¹, that in animals it may produce spasm here. On all tissues adrenalin has both an excitory and an inhibitory action; usually the former completely overshadows the latter, but occasionally the reverse may occur and this may explain this apparent anomaly in regard to the bronchial musculature. The pupils are dilated. The secretion of most of the glands is increased including those of the thyroid, parathyroid, liver and pancreas, all these probably being affected through the sympathetic system. The secretion of urine is lessened, probably through spasm of the renal vessels.

The local application of adrenalin is much employed in surgery to check haemorrhage and also to produce ischaemia of the mucous membranes prior to operation. It is frequently combined with local anaesthetics in order to increase the effect of these, the vascular spasm retaining them on the spot.

Adrenalin is much used in general conditions associated with a low blood-pressure, such as surgical shock, but its effect is very transitory and hence it is chiefly valuable in emergencies.

In Addison's disease and adrenal insufficiency, rest is very

¹*Amer. Jour. of the Med. Sciences*, July, 1920.

important, as syncope is common, and short of this the asthenia is great. The general treatment of these cases calls for no special remarks, beyond the evident one that they should in every way, by good feeding, fresh air, protection from wearing influences of all kinds, &c., be helped to save and possibly to regain their strength.

Tonics, such as iron and arsenic, may be indicated if there be any anaemia present and strychnine is of special value. This drug has been shown¹ to increase both the production and the output of adrenal secretion. It should be recalled that most of the severe cases are tuberculous, which suggests the direction in which our therapeutic endeavours should be made. If a strongly positive Wassermann reaction be present salvarsan and other specific remedies may be used in the hopes that the adrenals may still be saved.

DISORDERS OF THE THYROID GLAND.

GOITRE.

This is a chronic enlargement of the thyroid gland. The whole gland may be equally involved or one lobe only may be affected. In some cases the appearance of the enlarged portion is natural while in others the vessels may be much dilated, while degenerations are common and large cysts are often seen. Thus we have formed different types of goitre and these are amenable to treatment in very different degrees.

A mild form of parenchymatous enlargement of the gland is very commonly seen in women about the onset of menstrual life.

Goitre may occur sporadically but in many places is endemic and even epidemic. The essential cause is as yet unknown although much light has been thrown on it in recent years. The endemic form is undoubtedly connected with the water-supply in many places, and in India one would see nearly all the inhabitants of certain villages affected, while those of others would escape. The disease can be largely checked by the simple procedure of boiling or filtering all the water. This would suggest some infection as the cause and McCarrison has

¹*Ther. Gazette*, Nov. 1919, p. 796.

shown that not only will filtering the water stop the occurrence of the disease, but that the filtrate if given to people will produce it. Water contaminated with human faeces acts in the same way. McCarrison believes that the disease is due to the combined action of certain intestinal bacteria and an amoeba.

The common belief is that there is, from some cause such as this, an extra call upon the thyroid gland which hypertrophies in consequence in order to produce more secretion, and later the hypertrophied organ will probably degenerate and become fibrosed and often cystic.

Such cause is specially apt to occur if the iodine supply in any district is low, and it has now been shown both in Europe and America¹ that the occurrence of goitre is in inverse proportion to the iodine-content of the drinking water of a district. It follows from this that iodine should be given as a prophylactic in goitrous districts. An extremely small amount is needed for this purpose, and in Appenzell in Switzerland it is proposed to combine 0.25-0.5 gms. of pot. iodide with every 100 kilos of table salt. An average individual uses 10 grammes of table salt each day and thus would consume 0.025-0.05 mgs. of KI.

As a rule, goitre produces no symptoms unless the enlargement be so great as to cause pressure on the surrounding parts and especially the trachea, but sometimes there is evidence of underactivity of the gland with signs of myxoedema, or again of oversecretion with evidence of Graves' disease.

Diagnosis.—This is usually easy but it is also necessary to recognise the type of enlargement and also, if possible, the underlying cause. Is the goitre a parenchymatous, an adenomatous, a cystic or a malignant one, and are there any signs of over or under-activity of its functions?

Environment.—In every endemic case the water supply should be suspected and this, if possible, be boiled or filtered. Often a goitre will get better if the patient simply remove to another district.

Diet.—As just said, the water, if at all suspected, must be filtered or boiled. Red meats tend to stimulate the growth of

¹*Lancet*, March 31st, 1923, p. 660.

the thyroid gland and hence should be greatly limited or altogether avoided.

Specific Treatment.—Not only must the water be cared for but all sources of infection, such as infected teeth, tonsils, sinuses, &c., should be treated, as all such throw a strain on the thyroid gland and hence tend to cause its enlargement.

As mentioned above, is now known that minute doses of iodine will often prevent the occurrence of goitre. This has been found clinically and has also been shown experimentally in animals. Also, when goitre has appeared, it will lessen the enlargement to a certain extent. Potassium iodide, in doses of five to ten grains, is usually used for this purpose, or the mild tincture may be given in doses of 2-5 mins. Or thyroid extract may be given. Leo Loeb¹ recently showed that if in guinea pigs a part of the thyroid be removed, the rest of the gland tends to hypertrophy, and that this hypertrophy may be checked by the administration of the extract, but not by potassium iodide.

McCarrison found that a mixed vaccine gave excellent results.

Locally, much may be done to lessen the size of the gland when this is of the parenchymatous type. Iodine painted on the skin over the gland until this becomes sore is often effectual, but the best local application, in my experience, is the inunction of the B. P. red iodide of mercury ointment. The ointment must be rubbed over the tumour for about ten minutes with a bone spatula, and then the patient should sit for as long as he can bear it in the direct rays of the sun. About six hours later the ointment is applied a second time, very tenderly, and the patient is directed not to remove it. Somewhat severe blistering follows and usually the effect on the tumour is marvellous. If required, a second treatment may be used some months later. I have seen the good effects of this method of treatment in hundreds of cases in India, and can vouch for its efficacy.

The X-ray is often useful here and a few exposures will usually produce a very decided effect on the size of the swelling. Radium may be used in its place. It is the parenchy-

¹*Trans. Ass. Amer. Physicians*, 1919, 240.

matous type of goitre that is chiefly amenable to all the treatments so far mentioned. But when the enlargement is of the adenomatous, cystic and especially of the malignant type, then they have little effect and operative interference will be required if the tumour is to be got rid of. As already said, in many cases it produces no symptoms and then may well be left alone.

Symptomatic Treatment.—As a rule there are no symptoms, unless these be produced by pressure. If, however, there are any signs of hypothyroidism, then thyroid extract will be of assistance and may be given in doses of a grain or two thrice daily. If, on the other hand, the gland is too active then the treatment suitable for Graves' disease may be required. (q. v.)

HYPOTHYROIDISM. CRETINISM. MYXOEDEMA.

It has long been known that if the thyroid gland be removed or be destroyed by disease or be congenitally absent, a definite train of symptoms occur which are due to the absence of the internal secretion from the blood. When the condition occurs early in life, it is called Cretinism, when later, Myxoedema. The latter is much more common in women than in men and it is at least suggested that the atrophy of the gland is due to former overwork on account of menses and pregnancy. It remained for George Murray and Howitz to show that the symptoms could be more or less relieved by the administration of thyroid extract.

The thyroid secretion contains some substance which has a very large iodine content. The exact composition of this has been a matter of much research and various names have been given to the supposed active principle, such as Iodothyrim and Iodthyroglobulin. Recently Kendall, of the Mayo Clinic, has extracted a crystalline substance which he has termed *Alpha* Iodine or Thyrotoxin. This contains 60 per cent. of iodine and seems to be carbonic acid in which one of the hydrogen atoms has been replaced by diiodo-indol. But the thyroid also contains other bodies which exert some good influence in cases of cretinism, and hence, although *alpha* iodine

very powerfully exerts the thyroid influences, probably in treatment of cases of hypothyroidism it is better to use the whole extract.

In Cretinism, there is a great want of development in the child, so that at the age of twenty he may not appear to have more than the growth or mental calibre of a child of perhaps six or eight, or, indeed, may be idiotic. Also, besides mere want of development, there are other changes, such as a swollen bloated appearance of the face and body, with peculiar collections of fat at the root of the neck, &c.

In Myxoedema, the patient is pale and swollen, suggesting nephritis, but the swelling is solid in character. The skin is dry and harsh and the hair scanty and tends to fall out. The temperature is low and the mental attitude dull and listless. The whole picture suggests a lowered metabolism and this is found to be present.

Besides these well-marked cases there are all degrees of thyroid insufficiency. These cases are very common at all ages and it is very important to recognise them, as they can be so much relieved by specific treatment, although they are otherwise very unamenable to medication. People over 50 often show signs of depressed thyroid action, with dry skins, brittle nails and falling out of the hair, mental depression and insomnia, and they are greatly benefitted by small doses of the extract, say one grain daily in divided doses. All the uses of thyroid extract cannot be here discussed, but one may mention its frequent value in certain chronic skin diseases and also in adiposity.

The treatment of thyroid insufficiency is so essentially specific that this alone will be here discussed. It consists in the administration of thyroid extract or of its active principles.

The gland is usually given as the *Thyroideum Siccum*, of which the B. P. dose is 1/4-4 grains (3-25 centigrammes). One part of this represents about five of the fresh sheep's gland. Usually one grain t.i.d. is sufficient for an adult and seldom more than twice this dose is required. Children take it in proportion. An infant of one year can have half a grain in the day. Excessive doses are likely to bring on headache,

rapid heart action, tremor, a rise in temperature and loss in weight.

There are few more brilliant examples of successful treatment than may be seen here. Cretins will grow inches in a year and will quickly improve mentally if the treatment be instituted early enough. In adult cretins the effects are not nearly so striking and may be almost absent. Myxoedema is even more amenable to thyroid therapy than are cretins and the slighter cases of thyroid insufficiency quickly lessen. After the symptoms have cleared up, it will be necessary to continue the treatment indefinitely usually, although in smaller doses. To obviate this necessity, attempts have been made to graft pieces of the gland into the body, but these have not been very successful, and cannot be recommended.

HYPERTHYROIDISM. EXOPHTHALMIC GOITRE.

There are all degrees of over-activity of the thyroid gland, producing symptoms more or less severe according to the amount of the secretion poured into the blood. These symptoms are due to the excitation of the nervous and circulatory systems, with rapid pulse, tremor, flushing, sweating, and great increase in metabolism as revealed by an increased oxygen intake and an increased carbonic acid output, with loss of weight. In the slighter degrees we have the condition termed Hyperthyroidia and the "*fruste*" form of Graves' disease, while in the severer condition all the symptoms of the fully developed disease are present.

That all the symptoms of Graves' disease may be produced by an excessive dose of thyroid extract is shown by a case mentioned by Sir A. E. Garrod,¹ where a man took a thousand 5-grain tabloids of this in a space of five weeks with the object of reducing his weight. He developed signs of exophthalmic goitre of an extreme degree, all of which cleared up within six months.

Graves' disease occurring at the time of the menopause is peculiarly hard to treat and is apt to be associated with some mental instability.

¹*Lancet*, June 2nd, 1923, p. 1094.

As regards the treatment of Exophthalmic Goitre the fact dawns the brighter the more one sees and studies the course of these cases that many, even the majority, tend to improve after a while, and often recover completely under the most varied forms of treatment. It might even be correct to say that the disease tends to recovery in spite of some treatments. The lesson here is that in a condition which shows such a natural tendency to improve we should be very cautious in recommending any treatment which involves risk to life.

Environment.—Probably the most important single treatment of these patients is prolonged rest, physical, mental and emotional.

If the case be at all acute the patient should be in bed, and not only that, but for a time be kept horizontal, as any exertion or even the assumption of the erect posture will greatly hasten the heart's action.

As a rule, these patients do better away from home, either in hospital or a rest home, where they will be kindly but firmly handled by skilled attendants. In some acute cases the strict regime of the Weir Mitchell treatment is advisable. The patient should be as much as possible in the open air, but the glare of the direct sun should be avoided as it distresses the too-prominent eyes. When the condition is less acute the patient may get about, but for months at least should live the life of a semi-invalid, with much rest in the horizontal posture between times. One should avoid all forms of excitement. The ordinary calls of social life are often a great strain upon these hypersensitive people and must be avoided, as part of the treatment, as long as they feel this to be the case. It is often hard to make the relatives understand this. These patients as a rule do better in the country than the town so long as any symptoms remain.

In cases showing great excitement and sleeplessness prolonged warm baths are often very soothing and may be followed by refreshing sleep when otherwise this was impossible.

Diet.—This should be plain but abundant as there is a great increase in metabolism with a consequent loss of weight. It is always a good sign when the patient can be made to put on weight. It has been shown both clinically and experimen-

tally that a meat diet tends to produce activity of the thyroid gland. It is interesting to note here that alpha iodine will only hasten the pulse when protein food is also taken. This is thought by Kendall to be due to the association between the thyroid hormone and the metabolism of the amino-acids. Thus, not only does meat increase the production of thyroid secretion but it also enhances the action of its principal ingredient. Hence, meats should be omitted from the dietary and the total proteins should be kept as low as possible. A lacto-vegetarian diet is in all ways the best. All stimulants, such as tea, coffee and alcohol are better omitted.

Specific or Radical Treatment.—Graves' disease sometimes seems to follow focal infections and all such possible sources of irritation should be searched for and if possible removed. The teeth, tonsils and vermiform appendix are specially apt to be the sites of such trouble.

Various methods of treatment are used in this condition, always with the object of lessening the excessive secretion of the gland.

Beginning with the most simple, an ice-bag continuously kept applied over the thyroid and over the precordium gives much relief and no doubt acts in this way. Ergot, either as the fluid extract in half drachm doses or as Ergotine in one grain doses, has been used with the idea of contracting the vessels in the gland. Pituitrin is advocated for the same reason. The thymus gland secretion seems to have some controlling influence over the activity of the thyroid and has been used by many with some apparent success. The dose usually given is two to three grains of the dried gland t.i.d.

Various antithyroid preparations have been prepared and duly advocated. Such are Thyroidectin which is prepared from the blood of thyroidectomized animals; Moebius' Anti-thyroidin which is the serum of such animals; Beebe's Serum, which is the serum from rabbits which have been previously injected with an extract from the thyroid of a case of Graves' disease, and Rodagen, which is a powder made from the milk of thyroidectomized goats. None of these have at all made good and they are not much used nowadays.

If these simpler methods are not sufficient, and the case is

going down hill, either of two local treatments may be tried before resorting to surgery. These are injection of boiling water, or quinine and urea hydrochloride; and X-ray or radium treatment.

(1). The injection of boiling water into the thyroid gland, or a 30 to 50 per cent. solution of quinine and urea hydrochloride has given very good results in many hands. The little operation is done under a local anaesthetic. By the use of a long needle, all parts of the gland may be injected through a single puncture in the middle line. The amount of fluid (boiling water or the quinine and urea solution) injected ranges from 2.5 to 15 mils. The result is an immediate necrosis of thyroid tissue with a subsequent fibrosis, thus cutting down as much as may be desired of the secreting tissue. The treatment may be repeated twice weekly for a time, a different portion of the thyroid being attacked upon each occasion. Sajous speaks very highly of this method.

(2). Röntgen Ray therapy is now frequently used here and many good results have been attained. It is specially valuable where the thymus gland is also enlarged. The exposure is usually made daily for three days and then after a rest of three or four weeks is repeated. It must not be overdone or hypothyroidia may result. It is important that the thymus as well as the thyroid be exposed to the rays.

A series of 262 patients treated with Röntgen rays at the Massachusetts General Hospital was reported by Holmes & Merrill¹ recently. The results obtained were very encouraging. Fairly hard rays were used and the treatment not repeated for three weeks. After three such exposures an interval of three months was given and then the three exposures repeated. If necessary a third series was given, making nine treatments in all. Usually at the end of six months the patients were well enough to permit of their resuming their ordinary occupations.

In a comprehensive review of the results of X-ray therapy here Murray² cites 100 cases, "with 76 cures or nearly cured," and no mortality.

¹*Jour. of the Amer. Med. Ass.*, 1919.

²*British Med. Journal*, 1922, I, p. 905.

Radium has been used in these cases and seems to act in the same way as the X-rays.

Surgical Treatment.—Some of these cases will require surgical treatment, but in my humble opinion the percentage of these is small. The immediate risk of death from operation is considerable, the degree of this risk depending largely upon the skill and experience of the surgeon, but even under the most favourable auspices being present. Thus, in the Mayo Clinic it is about three per cent. and this is about the figure obtained in all the best centres. The ultimate results of operation are also not very reassuring. For example, of the 121 cases operated upon at the Mayo Clinic in 1909 and subsequently traced, 45 were cured, and this is in no way better than the figures for non-operative treatment. Also, the average period required to effect a cure in these cases was no less than 17.9 months.

The different methods of operation need not be mentioned here, but in all of them some of the gland must be left or myxoedema will result.

Even where most of the thyroid has been removed the symptoms may continue or recur, all of which points to the fact that the essential cause of the disease is not in the gland itself but lies deeper than this and in all probability is some error in its nervous control.

Symptomatic Treatment.—Seeing that we are so powerless as yet to check the excessive secretion of the thyroid gland or to neutralize its effects, it only remains for us in most cases to treat symptoms as they arise. And by so doing we do not merely mark time until the natural return to the normal takes place, but by placing the patient at rest, soothing the excitement, keeping up the general nutrition, &c., we undoubtedly hasten this return and may even in some cases so alter the balance as to cause a restoration when otherwise it would not occur.

An immense number of symptomatic remedies have been used from time to time and it would serve no useful purpose to enumerate them all here.

Theoretically, digitalis should do good, but a considerable experience of it makes me say that it has no effect upon the

rate of the heart here, and often disturbs the digestion which is very objectionable in these cases.

The employment of iron has given rise to much divergence of opinion, some thinking that it is valuable, while others condemn it. When anaemia exists, as is often the case, it seems natural to employ it, not for the treatment of the hypersecretion but for the blood condition.

Arsenic and Phosphorus are often used for their tonic effects and it is interesting to note that an Italian worker, Luigi Macaggi, found by experiments on dogs that these drugs lessen the secretion of the thyroid gland, apparently through changes produced in the secreting epithelium.

Quinine is much given in this disease and seems to have some good effect. The Hydrobromide, in doses of 1-5 grains, is the preparation usually employed. It was specially advocated by Forchheimer.

Calcium, in the form of the lactate, is often used, and I have seen several patients who have assured me of its influence in controlling the heart's action. According to Carroll,¹ there is some evidence that deficiencies of calcium in the diet may have played a part in the causation of some of the phenomena and that the higher plane of inorganic metabolism in the organism may have shared with adrenalin increase the responsibility in the production of thyroid hyperplasia and hyperthyroidism among soldiers.

Personally, I have found the bromides and belladonna to help these patients more than anything else. Ten grains of the former with ten mins. of the tincture of the latter may be taken for long with benefit.

Small doses of atropine slow the heart by central vagal stimulation and hence its value may perhaps be explained.

Electric treatment in the form of local applications of the galvanic or faradic current to the gland has been a good deal used and has sometimes at least a good psychic effect.

Nearly every physician has some favourite remedy in this disease, which all goes to show how little any individual treatment has to do with the cure when it occurs.

Any special symptoms, such as threatened heart failure,

¹*Amer. Jour. of the Med. Sciences*, 1919.

urgent diarrhoea, insomnia, &c., must be met by appropriate remedies.

Perhaps the best measure of the degree of activity of the thyroid gland can be made by the estimation of the basal metabolism.¹ The progress of the case can thus be studied very accurately.

The course of the disease is a long one and much patience will be required by both the patient and the medical attendant. It need scarcely be said how important it is that the physician inspire as much hope and cheerfulness as he can. He must do this in all diseases but in few with so much benefit as in the one under consideration.

DISTURBANCES OF THE PARATHYROID GLANDS.

The parathyroid glands produce an internal secretion which is essential to life, so that if these glands are removed from the body or are rendered functionless by disease the individual soon dies with symptoms of tetany. It is now believed that when tetany occurs and also certain spasmodic disorders in children, the underlying cause is a decrease in the parathyroid secretion. When only part of the gland tissue has been experimentally removed no symptoms may appear unless an extra strain be put upon the remaining tissue. This strain may be caused by pregnancy and also in some obscure way by the free administration of a diet of flesh.

From this it may be fairly assumed that certain tetanoid symptoms that may occur in pregnant women and infants or in certain infectious diseases may be due to damage of the parathyroids or an extra strain put on glands that were just sufficiently active to carry on when no such strain occurred.

Parathyroid secretion has also some influence over metabolism, so that when it is insufficient there is a tendency to emaciation and want of proper growth, a lowered capacity for dealing with carbohydrates so that glycosuria appears, and most decidedly of all an interference with calcium metabolism so that the teeth and the bones do not calcify properly. It has been found that the symptoms of parathyroid insuffi-

¹C. M. Wilson. *Lancet*, Nov. 20th, 1920.

ciency may be largely removed by the free administration of calcium and some authorities believe that the essential cause of these is the deficiency of this base in the blood.

Where there is reason to suspect an inadequate supply of parathyroid secretion in the body as shown by the appearance of tetany or muscular irritability, we can administer such as the dried extract, which represents about six times its bulk of the fresh gland tissue. The dose of this is 1/10-1/5 grain given about twice daily. The drug is not yet in any of the pharmacopoeias. It is usual to give at the same time free doses of calcium, say 10 grs. of the lactate thrice daily.

DISTURBANCES OF THE PITUITARY BODY.

The *hypophysis cerebri* consists of two lobes, an anterior and a posterior. The former originates from the roof of the pharynx and the latter from the floor of the third ventricle.

Complete removal or destruction of the pituitary body is fatal; partial removal leads in animals to stunting of growth, adiposity and failure of sexual development, and in adults to adiposity and genital dystrophy.

As regards the functions of the two lobes: the anterior one influences growth and development, and the chief element in its secretion is a substance called Tethelin: the secretion of this lobe is essential to life. The posterior lobe secretion presides over carbohydrate metabolism and that of fats and has a wide-spread stimulating influence upon non-striated muscle. Much experimental work has been done with extract of the posterior lobe. This is called Pituitrin and is not yet official in the B.P., but is so in the U.S.P., where there is a dried extract of the lobe called *Hypophysis Sicca* and a liquid extract termed *Liquor Hypophysis*. The preparation in liquid form most commonly used for all purposes is pituitrin which is a fluid extract of the infundibulum standardized by its influence on blood pressure and on the contraction of the uterus. The different drug firms also provide a dried extract of the anterior lobe of the pituitary body. Its use would seem to be indicated in delayed physical, mental and sexual development in childhood, and the dose is 1-3 grains t.i.d.

Pituitrin.—When this substance is injected into the blood it causes a rise in blood pressure and many other effects, most of which can be explained by its stimulating effect upon non-striated muscle fibre. While the effects appear superficially to resemble those of adrenalin they are essentially different, as in the latter these are brought about by indirect stimulation of the terminations of the sympathetic nerves.

Pituitrin causes very powerful contraction of the uterus and is much used in obstetrics where labour pains are weak and where there exists no obstruction to the exit of the foetus. It is a strong diuretic and is often employed for this purpose. It causes increase in intestinal peristalsis and hence is given in tympanites. The hormone decreases the sugar tolerance, possibly through its action on the cells of the Islands of Langerhans in the pancreas.

Pituitrin is much used in conditions accompanied by low arterial blood-pressure, such as surgical shock and also by some in heart failure. It has little effect upon the blood-pressure unless given intravenously or at least intramuscularly. The dose here is .5-1 mil.

ACROMEGALY.

Here we have disease, usually in the form of tumor formation, causing perverted function of the pituitary body, at first generally in the direction of increased action from primary irritation, and later of decreased action, from destruction of the tissues of the gland. If such irritation occurs early in life, Gigantism may result, and many cases of this abnormal condition have been shown eventually to have disease in the region of the pituitary body.

In acromegaly the peculiar alteration in the shape of the bones and especially in those of the face and of the extremities is connected with disturbance in the function of the anterior lobe of the gland, while adiposity, circulatory weakness, and at first decrease and later increase in sugar tolerance, suggests disturbance of the posterior lobe.

Treatment.—Little need be said here. Occasionally, brilliant results have been obtained by the early surgical removal

of an offending tumor. This development has been chiefly due to the work of Cushing.

Short of operation little can be done. In the late stages, when the secretion of the pituitary body is evidently lessened, the dried extract of the whole gland may be used, but the effects are largely disappointing. Thyroid extract appears to benefit these distressing cases occasionally and should at least be tried.

CHAPTER XX.

DISEASES OF THE DIGESTIVE SYSTEM.

FUNCTIONAL DISORDERS OF THE STOMACH.

Symptoms referred by the patient to the region of the epigastrium, and hence often believed by him to be due to disease of the stomach, are in the great majority of instances not of gastric origin, or, if connected with change in the function of the stomach, such as disturbance in motility, secretion or sensation, are not due to any structural change there, but are connected with the nervous control of the organ.

Dubois states (and it is hard not to agree with him), that 90 per cent. of dyspeptics owe their condition to nervousness, and should have nothing to do with restricted diet and medicines for the stomach. Irritation from distant parts of the body may be referred to the region of the stomach, as is seen in the gastric crises of locomotor ataxia. In sea-sickness the disturbance is certainly cerebral, and yet the mimicry of gastric trouble is perfect. The same thing may perhaps be said of the vomiting of pregnancy. In acute appendicitis how often is pain first felt in the epigastrium! Where an individual feels that he has heart trouble, in most cases there is nothing organically the matter with that organ, and the same remark may be made with equal force in regard to the stomach. Hence the need of a thorough examination and a searching inquiry into the history of the case, to exclude, if possible, organic disease, as the treatment of a patient in whom the stomach is structurally affected is very different from that of one where this organ is only functionally disturbed.

Even when it seems evident from our examination that the stomach is disordered, the disorder may not be of the nature or of the degree suspected. For example, in gastric flatulence it has long been believed that there is much fermentation of the stomach contents, but now we know that

this is a rather rare phenomenon, and that most of the gas expelled is air that has been swallowed or aspirated into the stomach. In so-called "acidity," when the patient suffers from acid eructations, the hydrochloric acid percentage is often low, and the patient may merely have a lessening of acid tolerance, or his acidity may be due to the presence of abnormal substances such as butyric or lactic acids. Even the significance of hyper-acidity after a test-meal is now thought less of, and Rehfuess has recently shown that such is just as likely to occur in a healthy person as in one diseased.

But in the midst of all these conflicting findings the physician will be called upon to treat cases of gastric distress, and, in spite of the many uncertainties, he can usually do much for his patients.

In connection with the stomach there are two symptoms which it will be convenient to discuss shortly before going on to the consideration of more definite entities. These are anorexia, and nausea and vomiting.

Anorexia.—Normally, there is no sensation from the stomach but that of hunger. Every one knows when he wants food, and yet the exact nature of the sensation of hunger is unknown, as is also its seat. Anorexia (want of appetite) may be due, (1) to absence of need of food, and this is a very common source of the condition in modern life where meals are frequent and exercise often limited. It is not an uncommon thing for the physician to hear the complaint, "Doctor, I never feel hungry," and yet when he inquires into the frequency and quantity of the meals, his one thought must be "no wonder," and rather than prescribing stomachics and appetizers, he should cut down the food supply, and it will not be long before hunger appears.

(2) Or the anorexia may be due to dulling of the afferent impulses from the stomach which are interpreted by the brain as appetite. This is seen in hysterical anorexia, in slight catarrhal conditions of the gastric mucous membrane, and also from various toxins. On the other hand, very slight irritation of the terminations of the nerves in the stomach will produce the sensation of appetite and this is partially, at least, how bitters act.

Bitters, then, tend to produce the sensation of appetite by their direct irritating action on the mucous membrane, but the chief way that they act here is reflexly from the mouth. When a bitter is placed in the mouth of a dog, while the stomach is being watched, an increased secretion of gastric juice, with augmented movements of the stomach wall and engorgement of the mucous membrane, are seen to occur, and all these changes go hand in hand with appetite. Thus, it is evident that when bitters are used in order to promote appetite they should be given in a way that will permit of them being best tasted; i.e., in fluid form.

There are three classes of bitters, viz.: simple, astringent, and aromatic.

The best examples of Simple Bitters are *Calumba* and *Quassia*, of each of which there is a tincture and an infusion. They contain no tannin and hence can be combined with iron without any precipitation.

Cinchona is an Astringent Bitter, and B.P. preparations are the liquid extract (does 5-15 mins.), the tincture (dose 30 to 60 mins.) and the acid-infusion (dose $\frac{1}{2}$ to 1 oz.).

In the Aromatic Bitters there is an essential oil, as well as the bitter principle. A good example of this class is Orange peel, of which the tincture, the syrup and the infusion are much used in practice.

Stomachics are substances which promote appetite, and include bitters and aromatics. Alcohol acts as a stomachic by its slightly irritating action, and sherry and bitters is a good example of a combined stomachic which the laity have long found of value. Various cocktails act in the same way.

Such a mixture as the following is useful in promoting appetite and can often be given with advantage during convalescence from acute disease.

R	Sod. Bicarb.	5ij.
	Tinct. Calumb.	
	Syrup. Aurant.	āā 5ss.
	Aq.	ad 5vj.

M.

Sig.—A tablespoonful thrice daily before meals.

A drop or two of Fowler's solution of arsenic are often of use in causing appetite, and no doubt act by slightly irritating the nerve-endings of the gastric mucous membrane.

The best stimulant, however, of appetite is the sight, smell and taste of food. Even the hearing about appetizing dishes will produce the changes that are associated with appetite, the stomach being thus psychically stimulated to prepare itself to deal with the expected meal.

If a meal be too long delayed then the sense of hunger becomes dulled, no doubt from fatigue of the nerve-endings. Stimulation is now of no use, but a rapidly absorbable nutriment, such as bouillon or beef tea, quickly revives them. Hence the wisdom of commencing a meal with soup, after which the revived stomach may deal with a solid meal when otherwise it could not do so.

Nausea and Vomiting.—These usually go together, but in varying proportions. Thus, at times we see intense nausea with little or no vomiting and at others (as in many cases of cerebral tumour) vomiting with very little nausea. Still, seasickness is purely cerebral and yet the nausea is very great.

Nausea and vomiting may be produced, (1) by irritation in the fauces, stomach or high in the intestinal tract; (2) reflexly from anywhere, as in renal calculus and uterine stretching; (3) or by irritation of the vomiting centre in the medulla, as in brain tumour, and as the result of various toxins.

Nausea and vomiting are often useful acts, and it may be necessary to encourage or produce them for various therapeutic purposes. They are accompanied by general muscular relaxation, and great secretion by the mucous membrane of both the stomach and the respiratory tract, and such effects are often valuable.

Emetics act either on the stomach directly or after secretion there, or on the vomiting centre; many act in both ways.

When we desire to induce vomiting we may do so in any of the following ways:—

(1) By irritating the back of the throat, as with the finger or a feather.

(2) By irritating the gastric mucous membrane:—

(a) With draughts of warm water, salt water, or mustard and water (a dessertspoonful to a glass of warm water).

(b) By the use of various emetics, which act partially by local irritation and partially by their effect on the vomiting centre after absorption. Such are:

Zinc Sulphate, dose 15-30 grs.

Copper Sulphate, dose 5-10 grs.

Ipecacuanha Wine, dose 2-4 drs. (One drachm, repeated every 15 minutes, is an excellent emetic for children).

Vinum Antimoniale, dose 2-4 drs. This is efficient but rather depressing.

(3) By irritating the vomiting centre by Apomorphine, dose 1/20-1/10 gr. hypodermically, or twice as much by the mouth.

Along with any emetic it is always well to give much warm water. This makes the vomiting easier, and also helps to wash out the stomach.

Thus, to repeat, emetics are used, (1) to empty the stomach of its contents, (2) to promote bronchial secretion and subsequent emptying of the bronchial tree, (3) and to cause general muscular relaxation. Probably the reflex vomiting in renal and biliary colic is of value in thus tending to reduce the spasm of the ureter or bile duct, which may be gripping the calculus and thus preventing its onward passage. Hence it is well to assist Nature, and an emetic is often of value here.

Gastric Lavage.—This is used when we desire to empty the stomach more thoroughly and with less depression than by the use of emetics. It is often employed also for the direct application of various medicinal agents to the gastric mucous membrane. The liquid used should always be of about body temperature. The tube ought to be some five feet in length, with a

calibre as large as possible in order to avoid easy plugging. The best one for adults is No. 20, made of red Para rubber, and with lateral holes.

The patient should be seated in a chair, and be told to swallow as hard as possible when the tube reaches the back of the throat. If he be nervous it is well to paint the fauces with a 2 per cent. solution of cocaine five minutes before the introduction. Cream makes a good lubricant for the tube if one be desired. The tube should be passed backwards, along the hard palate, and, as soon as it reaches the fauces, must be pushed down as rapidly as possible. There is usually a mark on it at 20 inches from the end, and when this mark reaches the incisor teeth the end will be in the stomach. It is now well to ask the patient to say "Ah!" so as to make quite sure that the tube is not in the air passages, before passing any fluid down it. Generally the first introduction of the stomach-tube causes a good deal of discomfort, but patients quickly get used to it and many learn to use it on themselves. When it is in position the fluid used is passed down it through a small funnel fixed at the near end. The nature of the fluid employed depends upon the gastric condition present. For mere washing out of the stomach a solution of bicarbonate of soda and common salt in the strength of one drachm of each to the pint is very useful, as it tends to dissolve mucus. A weak solution of permanganate of potash (1:12,000) is often valuable when there is much fermentation. While the fluid is being introduced the patient should be told to hold up his hand when he feels a sensation of distension, when it is at once stopped and the funnel-end lowered into a vessel, so that the current is reversed and the contents of the stomach are siphoned off.

A stomach-pump is seldom used nowadays, but in taking off a test-meal it is well to have a bulb on the tube, which will aspirate the contents, and press them on towards the receptacle.

Therapy of Vomiting.—As already said, vomiting is often a good thing and, like diarrhoea, should for the time-being rather be encouraged than suppressed, but frequently it per-

sists or exists when of no good service, and then requires treatment.

Diagnosis.—Before attempting to treat the symptom of vomiting, we must endeavour to find the cause and nature of it. Is it due to some gastric irritation; is it reflex from some distant source, or is there irritation of the vomiting centre itself? Is it a toxic condition or is it due to excitability of the nervous mechanism concerned? From any of these causes the patient may have vomiting, with more or less accompanying nausea, and yet the treatment required is quite different in, say, nervous vomiting from what it is in toxaemia, or again in gastric irritation. In the first of these, nerve sedatives, such as bromides and chloretone, are indicated; in the second, eliminative therapy, and in the last, local sedatives, like bismuth and alkalies.

SEA-SICKNESS.

This is an example of pure nervous vomiting, but it is necessary to be sure of the diagnosis. Many people, when they first sail, eat with unusual heartiness, and get little exercise; and, after a few days, become “bilious” and out of sorts, and believe that they are suffering from *mal de mer*, when really they are victims of over-eating, and the best treatment is to give an emetic, and if necessary a mercurial purge.

But in true sea-sickness the stomach may be empty, and yet the nausea and vomiting persist. Ordinarily, the condition is more distressing than harmful, but, if the voyage be a long one, it may produce a serious degree of weakness.

The patient should rest horizontal, and it is well to shade the eyes. All the fresh air possible must be provided, and if the sickness be not very severe the sufferer is often better on deck. He will want little food; the very sight of it will often increase the nausea. Occasionally he can take sips of iced champagne, when nothing else will stay on the stomach. Soon he may be given iced milk and soda, and gradually other light things as he improves. A tight abdominal belt often gives much comfort here.

A great many drugs have been tried in sea-sickness, which

shows that none of them are entirely satisfactory. Three stand out as giving most relief, and these are in their order of value (according to the writer's experience), chloretone, the bromides and belladonna, all being nerve sedatives. Five grains of chloretone, taken as often as every four hours, will frequently enable a person to complete a voyage without suffering, when without it he could not do so. It is well to commence the treatment some hours before the ship is likely to reach rough water. If the bromides are used they should be given in 20 gr. doses thrice daily, and their efficacy will be increased by the addition of 5 drops of tincture of belladonna, to each dose.

NERVOUS DYSPEPSIA.

Normally we are not conscious of any sensation in the region of the stomach, except that of hunger, but very commonly all manner of afferent sensory impulses arise, all referable to disturbances in sensation, motility or secretion of the stomach, not to mention those which have nothing to do with the stomach and are only referred there from elsewhere, or originate in the solar plexus.

No wonder is it that the ancients used to think that the soul dwelt in that region!

Distressing nervous symptoms connected with the epigastrium often have a definite relation to meals, but are as frequently relieved by eating as they are made worse.

(a) Disturbances of sensation. Epigastric pain or discomfort, as already said, may or may not be connected with the stomach. Such discomfort may be merely an uneasy gnawing, or sinking, feeling, or may amount to severe pain. It is, as a rule, made less by the taking of food, and worse by fatigue and any nervous strain. The terms "gastric headache" and gastric neuralgia have been used for such pain. There may be a local hyperaesthesia of the nerves here, but as likely as not, the condition is central and is merely referred to this region.

(b) Disturbances of gastric motility may be either in the direction of diminished or of increased tonus and peristalsis.

In diminished motility the stomach is limp and tends to sag and be long in emptying its contents.

Occasionally we see Acute Dilatation of the Stomach occurring as a complication of various diseases, and it is sometimes fatal in a few hours in spite of lavage and other treatment.

In the common chronic cases there is splashing for hours after the taking of food, and, from the delay in emptying, there is time for putrefactive changes to take place in the stomach contents, with the formation of gas and of abnormal bodies, such as butyric and lactic acids.

In time, this diminished tonus and delayed emptying may lead to gastritis and gastric atony, but the condition is essentially nervous and functional to commence with.

Gastroptosis is frequently associated with atony, and great comfort is often given in such cases by the wearing of a well-fitting abdominal belt.

In increased motility there is a tendency to cramps, which may be slight or so severe as to cause agonizing pain. There is frequently some local cause for such spasms, but, often, apparently, the condition is purely nervous.

Either of the sphincters may suffer from motor disturbance in the same way as the body of the stomach. In the case of the cardiac sphincter, when the tone is low, there may be regurgitation of gastric contents into the gullet with consequent heartburn, or air may be forced or aspirated into the stomach with resulting flatulence. When, on the other hand, there is spasm at the cardiac orifice, or a want of relaxation at the moment of swallowing, some dilatation of the oesophagus may result. This is commonly seen in hysteria. When the pyloric sphincter is hypotonic the stomach empties too soon, and intestinal disturbance, with lenteric diarrhoea, is apt to result. If this sphincter be over-active then delay in gastric emptying may occur. In infants, long-continued spasm of this sphincter is a not infrequent condition, and in time hypertrophy of the muscular ring occurs. The condition is a serious one, and may be fatal, and operation is sometimes required for its relief.

(c) The gastric secretion is very dependent upon nervous control. It was shown by Pavlov that in dogs even the smell

or the sight of food are sufficient to call forth a free secretion, and the placing of food in the mouth acts similarly. On the other hand, pain or fright will at once stop the secretion in animals, and every one has experienced in his own person the effect of such psychic influences upon digestion. Such checking of secretion may be partly the result of nervous stimulation of the adrenal and pituitary glands, as it has been shown that an increase in the hormones from these glands inhibit gastric secretion.

Lately, many writers have emphasized the influence upon gastric secretion of reflex impulses coming from a distance. Thus, chronic disease in the gall-bladder or the appendix may powerfully influence the secretions, usually in the direction of producing a hyperchlorhydria.

The gastric juice may vary both in quantity and in quality. The total secretion may be increased, either at the time of digestion, or continuously (Reichmann's disease), or the HCl percentage alone may be raised. On the other hand, the total secretion may be lessened, or the acid content may be decreased or even absent (achylia).

Hyperchlorhydria, where the percentage of HCl is too high (above .2 per cent.), as shown by a test-meal, has for long been supposed to be a common condition, especially in gastric ulcer, but doubt has recently been thrown upon this by Rehfuess, who showed in a large series of cases that it was no more common here than in the normal individual.

In hyperacidity pain is a common symptom, and is difficult to explain, because the HCl content can be artificially raised far above what ever occurs otherwise, without the production of pain. It is believed that the pain is usually of muscular origin. If an open ulcer exists, this might be irritated by an acid secretion, although a normal mucous membrane would not be so affected.

As already seen, the secretion of gastric juice may be lessened or completely inhibited in fright or shock, but this may occur in a less dramatic way in all kinds of diminished nerve tone, or in psychic distress, such as anxiety or worry. It leads to delayed digestion, with secondary changes in the gastric contents and the production of various abnormal pro-

ducts which may be a source of toxaemia and of gastric discomfort.

Diagnosis.—The treatment of functional conditions of the stomach should be largely in the direction of ignoring that organ, and of caring rather for the general nervous condition. But before this can be done with confidence it is necessary to make as sure as possible that there is no organic lesion present, either in the stomach itself or in some distant organ, such as the gall-bladder or appendix. Most practitioners have seen cases of prolonged dyspepsia turn out to be instances of chronic ulcer, or to have been due to an offending appendix or a diseased gall-bladder. But such cases are exceptional, and, although they should make us careful to exhaust every possible means of coming to a correct diagnosis, nevertheless, probably it is safe to say that nine out of every ten cases of "ordinary dyspepsia" are functional and have no organic basis in the stomach or elsewhere.

The *Lancet*¹, in commenting upon the different diagnoses made at different hospitals of cases admitted as "dyspepsia" says, "This suggests that at present the labelling of dyspeptic patients is a random and haphazard process which even in an up-to-date hospital is at the mercy of transient fashions, the proclivities and fancies of the individual physician. The labels—'gastric atony', 'ptosis', 'gastritis', 'achylia gastrica', 'ulcer', 'enteritis', 'colitis', 'constipation', and many others seem still to be distributed with the impartiality of ignorance."

A good test of functional as compared with organic disease of the stomach is to find out whether the patient has any trouble on a holiday or at a dinner party, or other social function where there is much diversion. If his symptoms do not appear in pleasant surroundings they are certainly not due to any serious organic cause. If he says, "When I enjoy anything I can eat it without trouble," or "When I go on a camping trip, I can eat anything," then his distress on ordinary occasions is functional, and is probably due to the absence of psychic secretion or motor control.

Environment.—Pleasant surroundings at meal-time are most important in nervous dyspepsia. An old Edinburgh

¹*Lancet*, June 9th, 1923, p. 1174.

teacher was accustomed, when a student would consult him about indigestion, to ask the question, "Do you eat alone?" and if the answer was, "Yes," he would advise him not to do so. Eating alone, with perhaps a book in front of one, is a sure road to nervous gastric disturbances. Worry will disturb the digestion more than work; a short rest in the recumbent posture after meals is often valuable, especially after the mid-day one, and this rest is of the greatest benefit if it be taken away from all worrying distractions, such as answering the telephone. In some people, however, gentle walking exercise seems to assist digestion.

Diet.—There is no doubt that the stomach can be functionally disturbed by errors in diet, but in the cases under discussion the cause is, as a rule, deeper; and beyond some simple, common-sense rules, the less the diet is restricted the better for the patient. It is safe to say that in these cases more harm than good is done by strict dieting, and if the patient will eat what he wants (barring a few exceptional things, which are manifestly indigestible, such as fried foods, oily fish, lobsters and crabs, etc.) he will do well.

Flint wrote thus: "I have never known a dyspeptic recover vigorous health who undertook to live upon a strictly regulated diet, and I have never known of an instance of a healthy person living upon a strict dietetic system who did not become a dyspeptic, and that in a great number of cases in which persons have been sufferers for years on a regulated diet, health has been speedily regained by simply eating in accordance with appetite."

Very often, strict regulation of diet is necessary, but this should only be for a short time and for some definite reason, and the patient must as quickly as possible be got on to an ordinary one. There is no field in which diet idiosyncrasies exist more than among nervous dyspeptics, and, while these vagaries must be respected, at the same time they should be made as little of as possible.

Specific Treatment.—The underlying cause of nervous dyspepsia is a lowered or perverted nervous control, and all radical treatment should be directed towards raising the general nervous tone, and not locally. In fact, the more the patient can

be convinced that there is nothing wrong with his stomach, and that it should be left alone, and as far as possible forgotten or ignored, the further he will be towards recovery.

Anaemia or some other general abnormality may be the cause of the lowered nervous tone, and must be appropriately treated if the gastric symptoms are to improve.

Symptomatic Treatment.—While we must always try to treat the underlying cause, there are often certain symptoms that may be relieved in the meantime. The alkalies, carminatives and certain sedatives are the medicinal agents usually employed here.

Alkalies are chiefly used when there are any symptoms of acidity, and, as Rehfuss points out, they often give relief even when no hyperacidity can be demonstrated, although the patient has a sensation of such. In these cases the patient is abnormally sensitive to acid. The action of alkalies is largely to neutralize any acid present, and they thus prolong the time for the digestion of starch by the ptyalin, but they also act as sedatives to an irritable mucous membrane, and they tend to dissolve mucous. Salts of sodium, magnesium and calcium are most employed as antacids, especially sodium bicarbonate, magnesium carbonate and chalk. These are often combined with bismuth,—for example,—sodium bicarbonate and bismuth carbonate of each 15 grains; or if a slightly laxative effect is desired then an equal quantity of the heavy magnesium carbonate may be used instead of the sodium salt.

Magnesium hydroxide and bismuth carbonate are the best substances for neutralizing acid in the stomach as they are less stimulating to further secretion than is bicarbonate of soda.¹

In slight cases of acidity the *trochiscus bismuthi co.* is convenient. Each lozenge contains two grs. each of bismuth and heavy magnesium carbonate, and four grs. of chalk.

Atropine or belladonna tend to lessen the gastric secretion, and occasionally may be used for that purpose, but should not be continued for long.

Carminatives are much used where there is flatulence and discomfort from retention of gas. Any aromatic will act as

¹T. I. Bennett. *Trans. Royal Soc. of Medicine*, January, 1923.

a carminative, but peppermint, ginger, cardamom and aniseed are the ones most commonly employed. They all seem to relax the two sphincters of the stomach, and perhaps to cause contraction of the body of the organ, thus expelling flatus, and at the same time relieving cramp. Pharmacologically the action of carminatives is hard to demonstrate, but few things are more certain clinically.

In babies with cramp in the stomach a mixture such as the following acts well:—

R	Spiritus Aether. Nitrosi	5ij.
	Glycerini	5iij.
	Aq. Anisi	ad 5liij.
	M.	

Sig.—A teaspoonful in hot water when required.

In adults the following is valuable:—

R	Tinc. Cardamom. Co.	
	Spirit. Chloroform.	
	Tinct. Zingib.	
	Glycerini	āā 5ss.
	M.	

Sig.—A teaspoonful in hot water when required.

In pyloro-spasm atropine in full doses will give the best results.

Opium and cocaine are, as a rule, contra-indicated in these cases on account of their after-effects, and also because of the danger of habit formation.

Chloretone is a valuable sedative in epigastric irritability, and may be safely given in 5 gr. doses, best before meals. Cerium oxalate was formally much used in the vomiting of pregnancy, but is seldom prescribed now. Its action was largely mechanical, like that of bismuth, as it is not absorbed, but some clinicians still believe that it has a greater sedative effect than can be thus physically explained.

Heat may be classed as a sedative here, and is often very valuable in painful conditions of the epigastrium, either applied externally as a fomentation or as a hot water bottle, or in the form of a hot drink.

In case of decreased HCl the dilute acid is frequently given

a short time after meals. The B.P. dose of this is 5-20 mins., but much larger quantities must be given if the acid percentage of the gastric contents is to be perceptibly altered. It is common to give as much as a drachm of the dilute acid one hour after each meal.

When "acidity" is due to acids of decomposition of food the HCl will often be of benefit, acting then as an anti-fermentative agent.

It is now known that the pepsin of the gastric juice is rarely deficient and hence it is seldom necessary to add it, but if it be so desired, the B.P. *Pepsina* may be given in doses of 5-10 grs. or the *Glycerinum Pepsinae*, in $\frac{1}{2}$ drachm doses. Pepsin only acts in an acid medium.

If the HCl be entirely absent we may use the *liquor pancreatis* after meals with advantage in doses of 1 or 2 drachms, but this preparation is chiefly employed for the predigesting of meals before administration, especially of nutrient enemata.

In deficient motility of the stomach, with sagging and delayed emptying, an abdominal belt may be worn with advantage. The meals should be small, and dry, and fluids taken between them and the last thing at night. Strychnine is the drug most used here in the hopes of improving the tone of the muscle. It has been shown by Berti¹ that small doses—less than 1 mgr. by mouth—act best in this way.

In slight cases of deficient motility this is all that will be required, but in more severe ones gastric lavage may be necessary. (q.v.).

¹*Trans. Royal Soc. of Medicine*, January, 1923.

CHAPTER XXI.

DISEASES OF THE DIGESTIVE SYSTEM.

GASTRITIS. GASTRIC AND DUODENAL ULCER. CANCER OF THE STOMACH.

ACUTE GASTRITIS.

Acute inflammation of the mucous membrane of the stomach may be due to irritants or to infection. The irritants may be swallowed, as in the case of corrosive poisons, irritating articles of diet, or alcohol; or may be produced in the stomach by the decomposition of food there.

Gastritis frequently complicates acute infectious diseases, such as typhoid, pneumonia and influenza, and such constitutional ones as nephritis and gout. It may here be a slight passing condition or (as in Phlegmonous Gastritis) be rapidly fatal.

When the gastric mucous membrane is very slightly irritated the first sensation is that of increased appetite. This is seen in one action of bitters and various other drugs, and is often therapeutically made use of. If the irritation be a little more, the appetite is first lost, then nausea and then vomiting are induced, and, lastly, a state of inflammation is reached with more or less damage to the epithelial lining of the stomach, with increase in mucus, etc.

Frequently the irritant is got rid of by vomiting, or by its passage onward into the duodenum, and our first endeavour must be to assist in this way.

Diagnosis.—The pain, nausea and vomiting, etc., usually make the diagnosis plain, but the exact cause of the catarrh is sometimes not so clear, although it can generally be found by careful investigation of the history and study of the case.

Environment.—Usually bed is indicated.

Diet.—At first it is better to give no food by the mouth. If the condition continues acutely for more than a day or two the nutrition can be partly maintained by the use of nutrient

enemata. (Page 321.) Frequent small drinks of hot water, containing a little soda bicarbonate, are usually grateful to the patient and soothing to the inflamed mucous membrane. Gradually, milk may be given, at first diluted and in small quantities, and later, gruels, broths, jellies, etc., may be added.

Specific Treatment.—As above mentioned, very often we can find and remove the cause, as in the case of irritating contents in the stomach, where a mild emetic or lavage are useful. If the cause be some poison, the appropriate antidote must immediately be used. Mercurial purgation is often of value, especially calomel, in frequent divided doses.

In Acute Infective Gastritis operation may give the only chance: short of this the stomach should be gently washed out with an antiseptic solution, such as boracic acid (1 oz. to the quart) or permanganate of potash, 1-1,000. Strychnine, caffeine or camphor may be required for the collapse.

Symptomatic Treatment.—Heat should be applied to the epigastrium in the form of fomentations or of mustard. Internally, alkalies and bismuth are usually given. The former neutralize the acid contents of the stomach, dissolve mucus and soothe the inflamed surface: the latter mechanically coat the mucous membrane and thus protect it. Fifteen grains of bismuth carbonate with an equal amount of bicarbonate of soda or of magnesium carbonate may be given every four hours. A useful mixture is the following:

R	Sod. Bicarb.	
	Magnes. Carb. Pond.	
	Bismuth. Carb.	āā ʒij
	Pulv. Tragacanth. Co.	ʒi.
	Mist. Cret.	ad ʒvi.
	M.	

Sig. A tablespoonful every four hours.

If at first the pain be acute morphia may be required.

CHRONIC GÁSTRITIS.

Here there are chronic changes in the gastric mucous membrane, usually with the production of much mucus and alteration in the gastric secretion.

Errors in diet, especially in regard to alcohol, are the common cause, and the long continued use of certain drugs, such as arsenic and iron may be to blame. The condition also commonly complicates various chronic diseases, especially heart lesions.

The symptoms are want of appetite, nausea and vomiting, emaciation and general ill-health. Very commonly there exists, as a secondary condition, atony of the muscular coat, with dilatation.

Diagnosis.—There are few diseases that are more frequently erroneously diagnosed than this. All manner of functional disturbances in or referred to the epigastrium are often called “gastritis” when really there is no inflammatory condition of the stomach present. The diagnosis can often only be satisfactorily made by an examination of the stomach contents, although in slight cases this is not necessary, and the practitioner who insisted on it every time he was consulted about gastric symptoms would soon become unpopular in the community.

Ewald distinguished three varieties of the condition, (1) Simple, where the fasting stomach contains only a small amount of slimy fluid, while after the test-breakfast the HCl is diminished or absent, (2) where a large amount of mucus is present, (3) where the HCl, pepsin and rennin are all absent. But perhaps a better division is into Hypertrophic Glandular Gastritis and Atrophic Gastritis. In the former we have the clinical features of an acid gastritis with some increase in mucus, in the latter the acid is deficient or absent, and usually there is a great increase in mucus.

In severe cases, cancer may be suspected, and an X-ray examination is often of value in helping to exclude this. Often, as said, chronic gastritis is a complication of such conditions as heart disease, nephritis, etc., so the practitioner must not focus his attention too much on the stomach and so miss the underlying cause.

Environment.—These patients are very apt to be introspective, and the more that their interest is fixed upon things outside their own bodily economy the better. In a few instances, however, the treatment can best be inaugurated by

a few days in bed. Later, they should be encouraged to take an interest in games and sport, and a change of air and travel will often be of value.

Diet.—In most cases a pure milk diet is the best; the patient may take 8 ozs. of this every four hours at first, and then it may be slowly increased to six imperial pints in the twenty-four hours; or other articles of diet may partly take the place of this increase, such as toast, biscuits, light puddings, and eggs. If milk does not agree it may be citrated or peptonized or diluted with lime or soda water, or butter milk may be tried. The last is especially useful when there is any constipation.

In the commoner milder cases it is more by excluding certain things than by saying what may be taken that the diet is best regulated. In the acid cases, potatoes and all carbohydrates should be restricted, and the diet consist largely of proteins and fatty food, such as cream. Pastry, hot bread and cakes, and fried foods of all kinds should be excluded.

In the atrophic cases only the softer proteins, such as eggs and fish, should be used, and the diet made up with cereals, bread and vegetables. Often here some of the predigested foods are of value. As a rule, butter, cream and olive oil are suitable in all cases of chronic gastritis.

As in nervous dyspepsia, so here, much idiosyncrasy often exists, and some people with slight gastric catarrh find that certain articles of diet disagree with them, although they suit apparently similar cases quite well.

Salt should be restricted in the "acid" cases, and given freely in the others.

Specific Treatment.—Often the cause of a chronic gastritis can be found and removed. Thus, alcohol, excessive drug-taking, indiscretions in diet (including the free use of iced water at meals), hurried eating, insufficient mastication (often from bad teeth), pyorrhoea alveolaris, etc., are usually removable. Excessive use of tea and coffee should be banned. When the condition depends upon some general disease, this must be treated if the stomach is to improve.

Symptomatic Treatment.—After the environment and the

diet have been carefully adjusted little more may remain to be done.

The most generally useful medication here is the use of bismuth and soda taken before meals. This soothes and protects the inflamed mucous surface and helps to dissolve the excessive mucus.

When acidity is troublesome, one may give sodium bicarbonate and magnesium carbonate (10 to 15 grs. of each), one hour after meals, and sometimes the addition of five mins. of tincture of belladonna to each dose will be of use in checking the secretion.

When the HCl is diminished or absent it seems theoretically right to give it by the mouth, and it undoubtedly does good, although it would have to be given in enormous doses to perceptibly alter the percentage of acid in the stomach-contents. It has been stated by Sippy, that it requires nearly 100 drops of the dilute acid to aid in the digestion of even half an ounce of albumen, and thus a patient on a diet of a hundred grammes of protein would require six hundred to seven hundred drops of it, an amount that could not be given by the mouth. Reh fuss showed that in a case of anacidity it took 250 c.c. of 0.25 HCl to produce a curve at all like the normal. Probably medicinal doses act rather as a stimulant of hormone secretion. At least 20 mins. should be given after each meal, well combined with a bitter and an aromatic, such as in the following:

R	Acid. Hydrochloric. Dil.	℥ss.
	Liq. Strychn. Hydrochlor.	℥j.
	Syr. Aurant.	℥ss.
	Aq. Chloroform.	ad ℥vj.
M.		

Sig.: A tablespoonful in water three times daily after meals.

The nitro-hydrochloric acid is often useful in these cases, especially if there be any hepatic torpor.

In the achylic cases, when acids are not well borne, they should be stopped, and the diet so arranged as to depend upon

intestinal digestion of the proteins. For the aiding in the digestion of starch in these cases, Taka-Diastase is useful, in doses of 2-5 grs. after meals.

The employment of mineral waters in cases of chronic gastritis has much backing of experience. All these waters act better at the various spas at which they occur than when bottled and used at a distance, or when chemically similar substances are substituted for them. Probably the chief cause of the good effects of such watering-places is the freedom from business or domestic cares, the out-door exercise, enforced regularity in habits of eating, sleeping, etc.

Cases of chronic gastritis can often be sent to such places with great benefit, and if they cannot afford the time or the money for this may get some relief by taking the waters at home. Generally speaking, the "acid" cases (chronic glandular hypertrophic gastritis) should be given alkaline waters, such as those of Carlsbad in Europe, or Bedford Springs in America. As a rule, one glass, taken hot, half an hour before breakfast, will be beneficial, and may be repeated before the other meals if not found too laxative. In cases showing deficiency of HCl, those waters containing much sodium chloride and CO₂ are best. The waters of Rokoczy Spring at Kissingen and those of Homburg and Ems in Europe, and of the Congress Springs at Saratoga are of this character, and may be recommended.

Electricity is often used in chronic gastritis, and seems to be of value. The effect is probably largely psychic, but there is some accumulating evidence that both the motility and the secretion of the stomach may be effected by it. The most efficient method is by the use of an intra-gastric electrode. The galvanic current is used for abnormal sensations in the epigastrium, such as gastralgia, and for the checking of hypersecretion. When the secretion is deficient or the motility poor the faradic or the sinusoidal currents are most used. But the use of electricity here is a very special subject, and should not be attempted by the practitioner unless he has had such training.

GASTRIC AND DUODENAL ULCER.

This is, as a rule, a disease of early adult life, although, when once established, it may persist for many years.

From a therapeutic point of view, ulcers of the stomach and duodenum may be taken together, as their differentiation is difficult and the treatment very similar.

Gastric ulcers are often multiple; duodenal, nearly always solitary. Occasionally both kinds occur in the same patient.

The classical symptoms are pain and tenderness in the epigastrium, vomiting and haematemesis, and melaena. Often hyperacidity is present, although not to the extent or constancy once thought. The pain may be aggravated by the taking of food, but is often worse some hours after a meal (hunger pain), and is relieved by bland foods or alkalies. It is here usually associated with hyperacidity.

Our objects in treatment are to promote the healing of the ulcer, by resting the stomach as much as possible, and by preventing the irritation of the lesion by rough food and acid gastric-juice. Three essentials in the medical treatment are rest, proper dieting, and the use of antacids and antispasmodics.

Diagnosis.—The recognition of an ulcer is easy, when the characteristic symptoms are present (especially haematemesis and melaena), but in many instances it can only be suspected and, unless confirmed by operation, the diagnosis may remain in doubt.

The chronic form of ulcer is characterized by exacerbations and remissions, often occurring over many years.

The examination of the gastric contents for occult blood and debris, and the use of the X-Ray, are of great value in helping towards a conclusion. In doubtful cases it is well to assume that an ulcer is present and to shape the treatment accordingly.

Environment.—In all except slight and very chronic cases the patients are best in bed. The stomach is thus largely rested mechanically, and also less food is necessary. In acute recent cases, three weeks' complete rest may only be required, but in the more chronic ones this may have to be prolonged for several months.

Diet.—During the first few days of treatment, as a rule, no food should be given by the mouth at all, and little fluid, but the patient may suck fragments of ice. Chewing gum is sometimes a comfort here and the patient can swallow the saliva.

Thirst may be largely relieved by injections of water by the bowel, and a decinormal solution of bicarbonate of soda can be used with advantage for this purpose, as it lessens the chances of acidosis from the starvation. If injections are not well borne the fluid may be given by the Murphy method, and three or four pints can thus be comfortably administered in the twenty-four hours.

If the prohibition of food by the mouth lasts longer than three or four days it is well to feed by the bowel.

Nutrient Enemata.—Our power of feeding by the bowel is limited, and the caloric needs of the body can, at the best, only be thus partially supplied. Very many of the enemata commonly used in practice are of little value, as they are not absorbed. Water and salts are freely taken up by the bowel, and also grape sugar. Proteins are not absorbed well even when predigested, and fats probably not at all. Alcohol is well taken up, and is of some value here as a food.

A useful enema is that recommended by W. E. Fothergill, as follows:

Glucose	50.
Alcohol	50.
Calcium Chloride	00.3
Sodium bicarbonate	3.
Sodium chloride, or bromide	4.
Distilled water to	1,000. parts

1,500 c.c. of this equals 825 calories, and this amount can be given in the twenty-four hours in enemata of 250 c.c. each every four hours, or in greater amounts less frequently. It should be given very slowly and as high as possible.

If the bowel be irritable, a few drops of laudanum can be added to each injection.

In feeding by the mouth a diet that will not mechanically irritate and one that does not stimulate acid secretion is the

best, and milk well fulfils these conditions. It should be given frequently in small quantities; say, six ounces every two hours, and then less frequently and in larger amounts as the patient improves. Its nutritive value can be increased by raising the percentage of cream. In acid cases it is well to add lime water, or, better still, the B.P. *liquor calcis saccharatus*, which is twenty times as strong; a teaspoonful can be added to each glass of milk. If the milk still disagrees, it may be diluted or peptonized. Occasionally, buttermilk suits well.

Next, arrowroot and other carbohydrates may be added, and gradually more substantial foods.

Such a diet is usually satisfactory, but there are several special ones which must be mentioned.

(a) The Lenhartz diet. Here milk and eggs are used. Raw eggs are beaten up and iced; some milk is also iced, and the egg and milk feedings are alternated every two hours in such amounts that two eggs and 6 oz. of milk are used in the first twenty-four hours; and the quantities are so increased that by the sixth day seven eggs, and 22 ozs. of milk are given. A little sugar is added to the milk after the third day. At the end of a week the number of eggs is reduced, and some scraped beef substituted. During the second week the eggs may be lightly boiled, and the milk increased to a quart; and by the end of this week, bread and butter, and other soft articles are gradually added. The food need not be iced after the first week.

Lenhartz commences this diet at once, even in the presence of recent haemorrhage.

(b) The Sippy Diet consists, in brief, of a preliminary starvation for 3-5 days (during which the thirst may be relieved by the use of normal saline by the bowel), then frequent feedings, and the use of much alkali. 1-3 ounces of a mixture of equal parts of milk and cream are given every hour from 7 a.m. to 7 p.m. When milk is thus given in small quantities it largely passes directly into the bowel, and is there digested. After a few days, lightly-boiled eggs and well-cooked cereals are gradually added. By the tenth day the patient is receiving three ounces of the milk and cream mixture every hour, and three eggs and nine ounces of cereals in the twenty-four

hours. Cream soups, egg nog, and liquid custard may be gradually substituted, and then bread and butter, etc. Between the feedings the patient is given alkalies freely to neutralize the acid secretion.

In a few cases of gastric ulcer food causes so much distress that Duodenal Feeding may be necessary. The Einhorn Duodenal Tube is here used, and is occasionally an apparatus of great value. The tube conducts the food straight into the duodenum, and thus the stomach is entirely spared. It is about one metre long and of three millimetres calibre; at the end is a metal tip with perforations. This is swallowed, and in a few hours usually enters the duodenum. This is at about 28.5 inches from the incisor teeth. We know that the end is in the duodenum when gentle aspiration through the tube reveals fluid of the character of duodenal contents, and when milk swallowed past the tube cannot be aspirated through it. The X-ray, however, is the most certain way of proving that the tube is *in situ*. It is secured to the cheek by a piece of strapping, and should be removed once a week for thorough cleansing. Liquid food at body temperature is passed down it by means of a funnel. Peptonized milk and cream, raw eggs and lactose are the best foods here. Three ounces is usually all that can be used at a feeding at first without distress, but this can gradually be increased. The feedings should be repeated every two or three hours. The tube is usually worn without discomfort, and the patient can swallow past it, if he desires, and thus disposes of his saliva. When not in use, the upper end is curled round one ear. It gives rise to little inconvenience, and one may see a patient enjoying his pipe quite in the ordinary manner with the tube *in situ*.

The duodenal tube can be used in many other conditions besides that of gastric ulcer; for example, in cancer of the stomach, and it is frequently curative in hysterical vomiting.

When the symptoms of ulcer have disappeared, which is usually the case in four to six weeks in acute ulcer, the patient may be cautiously got on to an ordinary diet, but for long this must be a simple and non-irritating one. Alcohol should be prohibited. Mild alkaline drinks, such as Vichy water, are useful.

Specific or Radical Treatment.—Acute ulcer is due to infection and all possible sources of this, such as teeth, throat, gall bladder and appendix should be thought of and if possible treated. The only therapy that can be termed radical is surgical, and then only when the ulcer is excised. Operation is indicated in cases that long resist medical treatment, and in those having complications, such as prolonged or frequently recurring haemorrhage, and in pyloric obstruction. Any symptoms of gastric perforation urgently indicate operation, and every hour of delay here increases the danger of life.

Every case of gastric or duodenal ulcer that is not doing well should be seen in conjunction with a skilled surgeon. The condition is one of those where "team work" is very necessary. The various kinds of operation that are now done for the relief of ulcer here cannot be discussed. Sometimes the ulcer is excised or otherwise attacked, but usually a gastro-enterostomy is done, and the ulcer is left, but now tends to heal.

In chronic gastric ulcer gastrectomy seems to be the ideal operation. In the hands of such experts as Sir Berkeley Moynihan there is practically no mortality, but it is well to remember that few surgeons have had the experience that belongs to him.

Even when operation has been done, the need for careful medical treatment remains. The mortality after operation in skilled hands upon gastric and duodenal ulcers is about 4 per cent., but in less skilled surroundings it is undoubtedly much higher than this.

The possibility of a chronic gastric ulcer taking on malignancy is often used as an argument for its radical removal, but in my limited experience such a risk is small, and this is the opinion of B. H. Spilsbury.¹ All the same there is a small risk of such a complication.

Symptomatic Treatment.—All cases of ulcer should be put on alkalies and bismuth, and this treatment kept up for a long time. The best form of these is probably sodium bicarbonate and bismuth carbonate powder (of each 10-15 grs.), given before meals, but not oftener than every four hours: magnesium carbonate may replace the sodium salt, especially if

¹*Trans. Royal Soc. of Medicine*, October, 1922.

there be any constipation. Carlsbad salt is often a valuable antacid here, and may be given in teaspoonful doses in water once or twice daily. Belladonna (or atropine) is often useful when there is much acidity, and it also tends to diminish peristalsis, and hence to rest the organ. It may be given in five minum doses of the tincture every four hours, and, if necessary, gradually increased until dryness of the mouth and dilatation of the pupils give warning that the full physiological action has been attained.

If the pain be severe and not relieved by alkalies and belladonna, Orthoform often gives relief in doses of one to three grs. as required. In rare instances a little morphia may have to be added to the powders for a short time, but should be discontinued as soon as possible.

Heat to the epigastrium in the form of fomentations has some action in the relief of pain, and may be used except in cases where haemorrhage has recently occurred, when it is safer to use ice. Some advocate the use of hot fomentations in every case except in those of recent haemorrhage, believing that they facilitate the healing of the ulcer.

In chronic ulcers with gastric distress, silver nitrate in aqueous solution is of value. Lockwood advocates the use of this in nine day cycles, as follows:—during the first three days half a grain is given three times daily; during the second three days three-quarters gr. t. i. d., and during the third three days five-sixths gr. t.i.d. This completes the cycle, and it may be repeated occasionally as required. It is specially useful when chronic ulcer is accompanied by high acidity and much pain. Or, instead, we can use 1:6000-1:4000 solution of silver nitrate, introduced into the stomach to the extent of six ounces, and quickly aspirated out, and followed by sterile water, and then by any bland alkaline solution.

If hyperacidity be great and vomiting very distressing, and these are not relieved by other means, gentle lavage with soda solution is sometimes advisable, and this can be conveniently done through a duodenal tube, passed only as far as the stomach.

Haematemesis.—Any signs of haemorrhage call for immediate and absolute rest; all food by the mouth should be with-

held, but the patient may be permitted to suck ice. An ice-bag over the epigastrium is often used, and may possibly be of some value. If the patient be at all excited, it is well to give a hypodermic injection of morphia. Various local astringents and vaso-constrictors are used in the hopes of checking the bleeding. The ones most commonly employed are adrenalin solution (1:1000), in doses of $\frac{1}{2}$ -1 drachm, or tannic acid, 5-10 grains in cachet. Monsel's solution (*Liquor Ferri Persulphatis*) in doses of 3 mins., diluted with water, is a powerful astringent and may be used here.

If the bleeding persists we may employ substances which increase the coagulability of the blood, such as calcium chloride or lactate, or use gelatine or horse serum subcutaneously. Gastric haemorrhage is seldom directly fatal, as the loss of blood itself reduces the blood-pressure and hastens coagulation, but deaths do occur from it. I saw two such during five years of military service.

When haemorrhage persists or often recurs, the question of surgical intervention will come up, and occasionally is necessary, but most surgeons are chary about operating during severe bleeding and would rather wait, if possible, until it has stopped.

Perforation of an ulcer may occur. It is productive of intense pain and collapse, and urgently requires operation. Until this is done, absolutely nothing should be given by the mouth. Slow perforation also sometimes takes place, with closure of the opening by peritoneal adhesions, so that the condition does not produce general peritonitis. But it is a serious one, and the care of the case should always be shared with a surgeon.

CANCER OF THE STOMACH.

Diagnosis.—Where gastric symptoms exist along with progressive emaciation in a person over forty, the possibility of malignancy should always be kept in mind. The absence of free HCl in a test-meal is suggestive, but the examination of the stomach with the X-ray after a barium meal is the most certain method of establishing the diagnosis, short of an exploratory incision.

The immense importance of an early diagnosis is evident when one remembers that at this stage excision of the portion of the stomach containing the growth may be curative; whilst later on, when glands, and perhaps the liver, are secondarily involved, it is useless.

Treatment.—Short of complete removal of the cancer, all treatment is, of course, purely symptomatic, and yet it is important, as much may be done to make the remaining weeks or months of the sufferer's life bearable. One of our chief functions as physicians is to ease human suffering, and there are few instances where this is more important than in this dread disease.

Some years ago a patient with pyloric cancer was indeed a pitiable object. He is so still, but not to the same extent. Then, little could be done beyond the giving of antiseptics, and the use of morphia for the pain; and soon the stomach became a veritable cesspool, which was only partially emptied by occasional vomiting. Putting food into such a stomach simply made matters worse. Now operation should be considered in every case, and, if done early, may be curative; and if removal of the mass be impossible, a gastro-interostomy will probably give much relief for the time-being.

But if operation is not done or is partially unsuccessful, we still have many ways of easing the suffering.

In the first place, gastric lavage, done with sodium bicarbonate solution or with some antiseptic, such as 1:10,000 permanganate of potash, will periodically empty the stomach and preserve it from gross fermentation. This should be done at least once in the twenty-four hours, best the last thing at night.

Next, by the use of the Einhorn duodenal tube, the patient may be completely nourished without any food being in the stomach at all. He may also be partially nourished by rectal feeding.

Often bismuth and soda in large doses are valuable, and sometimes, where there is fermentation with the production of butyric and lactic acids, free doses of HCl are useful. A good way of giving this is in acidulated milk: here sufficient of the dilute acid is added to a glass of milk to cause a reaction for free acid to Congo paper.

When there is any pain, olive oil before food sometimes is of value. Or we can use a 2-5 per cent. solution of Anaesthesin in olive oil, giving a couple of drachms of this (representing 2.25-5.5 grs. of the drug) before food. Sometimes orthoform may give relief, in doses of 2-3 grs.

Haemorrhage is of frequent occurrence here, and may be treated as discussed under the heading of gastric ulcer.

By such means the discomforts of the patient may be lessened, but the progress is inevitably downwards, and, if suffering occurs, it is our duty to ease this by the free use of opium or derivatives of it. There is no question of habit-formation here. The best preparation for the purpose is, in my experience, Omnopon (Pantopon), which is a substance containing all the alkaloids of opium in the form of soluble hydrochlorides. One grain of it corresponds to five grains of B.P. opium; in other words, it is five times as strong as the pure drug, and must thus be used in proportionately smaller doses. Its action may be enhanced by combining with it some scopolamine (hyoscine). The effects of omnopon are very similar to those of morphia, but the after-effects are less. It can either be given by the mouth or hypodermically.

By the use of this, or of some other opiate, the last days of these patients can be made bearable and fairly comfortable and life, even, may be prolonged.

CHAPTER XXII.

DISEASES OF THE DIGESTIVE SYSTEM.

JAUNDICE. GALL-STONES. CHOLECYSTITIS. PERITONITIS.
ASCITES.

JAUNDICE.

This merely is a symptom, just as are albuminuria, oedema, etc. It may be due to various causes, which bring it about either by obstruction to the onward flow of the bile so that absorption takes place; or to conditions producing a breaking down of red blood cells with consequent increase in the amount of bile, or in its consistence. Many believe that jaundice is always really obstructive, and that in the latter (Haematogenous) form the real cause of the condition is absorption due to obstruction in the bile capillaries, or to alteration in the consistence of the bile, so that it does not flow with sufficient ease through these fine passages.

Various infections, such as malaria and septicaemia, are apt to be accompanied by a degree of jaundice, and one infection specially (that due to the *spirochaeta icterohaemorrhagiae*) produces a deep and often fatal form. When jaundice appears in any blood infection it is usually of grave significance. Various chemical toxins also, especially arsenic and phosphorus, may cause profound changes in the liver, with much jaundice, the condition resembling acute yellow atrophy of the liver.

Diagnosis.—As jaundice is only a symptom, the underlying cause must be searched for, and if possible removed. If the case be of the frankly obstructive type, bile will be more or less absent from the stools, and will appear in the urine, and other excretions. In the haematogenous forms bile still appears in the stools, and the urine may contain no bile pigment.

The commonest cause of jaundice in sporadic cases is catarrh of the common bile duct, and as this is the form that is most amenable to treatment it will be taken here.

CATARRHAL JAUNDICE.—The condition is due to a catarrh and consequent thickening of the mucous membrane of the

common bile duct in the vicinity of the ampulla of Vater, with consequent obstruction to the flow of bile. The actual cause of the jaundice is probably a plug of mucus obstructing the narrowed orifice of the duct.

The catarrh is usually associated with a similar condition in the stomach and duodenum, where the inflammation, probably, generally starts, and later spreads to the bile-duct. Commonly there is a history of some days of anorexia, and nausea, etc., and then the jaundice appears, but sometimes it is the first thing noticed. It may follow some indiscretion of diet, or a chill, or some infection such as influenza. Besides the jaundice, the poisoning with bile causes general depression, and often itchiness of the skin and a tendency to slow pulse and to haemorrhages.

Diagnosis.—The jaundice is of course evident, but the exact nature of it is often for a time in doubt, and we are uncertain whether the case be one of simply catarrhal jaundice or whether it be of more serious origin.

While making every endeavor to get at the true nature of the case, it is well, in the meantime, to treat it as of the catarrhal variety.

Environment.—The patient should be in bed at first, and for as long as there is any fever, but need not necessarily be kept there until the jaundice is completely gone.

Diet.—Bile is not entering the alimentary tract, and very probably also the pancreatic secretion is dammed from the same cause. Thus the digestion of fats is interfered with, and these appear in the stools, and give them the characteristic appearance and consistence. Hence, it is well to exclude fat from the diet. This may consist of skimmed milk, carbohydrates and sugar. Meats should be limited, as they tend to increase the amount of bile and are apt to putrefy in its absence. A full diet should not be resumed until the jaundice has quite disappeared. The free drinking of water is advisable, and the various alkaline natural waters, such as Vichy, are of benefit here.

Specific Treatment.—There is no treatment that really comes under this heading, although the care of the catarrh is in a way radical.

In the acute infectious form of jaundice, due to spirochaetic invasion, injections of salvarsan have apparently been of some value. Also the intravenous or intramuscular injection of the serum of convalescents, or of goats or horses immunized with the *spirochaeta icterohaemorrhagiae* has given good results.

Symptomatic Treatment.—The duodenal catarrh may be lessened by the free use of alkalies and bismuth, which may be given in doses of 10-15 grs. of each, before food, as often as every four hours. If we can make the bile thinner it will pass through the obstruction more easily, and various mineral waters, such as Hunyadi Janos or Carlsbad, are believed to have some action in this way, and in any case they relieve the constipation which is nearly always present. Ammonium chloride and salicylate of soda also tend to make the bile more fluid, and are frequently given here, in doses of 5-10 grains t.i.d.

Heat, in the form of wet-compresses, applied over the liver, and frequently changed, is useful, especially if there be any pain.

The constipation may be relieved by salines, such as the effervescing phosphate of soda, and at the commencement of an attack a mercurial purge is of value. The purgative resins, such as those of Jalap, Scammony, and Gamboge, do not act well in the absence of bile, and hence are not applicable here.

In chronic cases of jaundice, pruritus is often troublesome, and may be lessened by alkaline baths or by mopping the skin with a 2% solution of menthol in alcohol. If the itchiness be not thus relieved, pilocarpine nitrate, given hyperdermically in doses of 1/20-1/10 gr., is often of value.

When the jaundice is clearing up, the improvement may be hastened by the use of bitters and the dilute nitro-hydrochloric acid, as in the following prescription:—

R	Acid. Nitro-hydrochlor. Dil.	5ij.
	Syrup. Aurant.	℥ss.
	Infus. Calumbae	ad 5vj.
	M.	

Sig.—A tablespoonful in water three times daily before meals.

In the presence of jaundice, any surgical procedure must be approached with caution, as bleeding is apt to be profuse and hard to check. Spontaneous haemorrhages are also apt to occur, and may be difficult to control.

An attack of catarrhal jaundice does not usually last more than three to six weeks, and, if, in any case, it is not tending to clear up by then, the presence of some more serious condition must be suspected. Occasionally, however, these cases may drag on for months, and yet clear up completely, so that a grave cause, such as malignancy, need not be too surely assumed.

In persistent cases of jaundice the flow of bile may sometimes be re-established by the introduction of a 25 per cent. solution of magnesium sulphate into the duodenum through a duodenal tube. 50 mils of the solution are passed in once a day, the procedure being carried out in a fasting state. It relaxes the common bile duct and thus permits of a free flow of bile. The method has been much used by Vincent Lyon who has written a comprehensive book upon it.

CHRONIC CHOLECYSTITIS and GALL-STONES.

Biliary calculi form in the gall-bladder as the result of some infection there: very commonly this is typhoid. Long after the infection has died out, the stones may continue to grow by further deposit of cholesterin, lime salts, and bile pigment.

Diagnosis.—As long as gall-stones remain in the gall-bladder and there is no active infection, no symptoms may occur, and the mere discovery of their presence in the course of an X-ray examination does not necessarily imply operation. Moreover, they are often present and yet do not show with the X-ray, this being specially true of those consisting chiefly of cholesterin.

Gall-stones are said to be present in four per cent. of all adult males, and twenty per cent. of all adult females, especially in the obese (Rendle Short). In only a few of these are any symptoms present, although there is no doubt that many people have indefinite abdominal and, especially, epigastric

discomfort, with gastric symptoms and hyperchlorhydria, owing to the presence of gall-stones.

Treatment.—Much medical treatment has been tried with the object of dissolving the stones, but the results of them all are doubtful, and they need not be discussed at length here. There is much clinical evidence that olive oil gives more relief than any other medication in patients suffering from symptoms of cholelithiasis. The oil (which should be pure) is given in doses of three to four ounces in the early morning. Some prefer to give an ounce after each meal. The effect is distinctly laxative. Oils and fats become disintegrated in the alimentary tract, and pass into the blood as unchanged fat, as fatty acids and as soap, all three of which dissolve cholesterin readily. All the same, fatty foods other than the olive oil do not, as a rule, suit these cases, and are better avoided.

Various saline waters such as Carlsbad and Vichy, have some value here, and probably lessen the catarrh that the calculi tend to set up. Spa treatment is often advisable.

Chronic Cholecystitis.—This is a fairly common condition apart from gall stones. The diagnosis is often difficult, but persistent belching of gas, and constant pain and tenderness in the region of the gall bladder are suggestive. The liver is frequently somewhat enlarged. Often such patients have a tint of jaundice and show a resentment to fatty foods. If such cases resist ordinary medical treatment, especially the regular use of saline purgative waters, the question of an exploratory incision should be considered, and if the gall bladder be then found to be much diseased it should be removed.

When gall-stones are giving rise to distinct symptoms, such as vague discomfort and pain in the right hypochondrium, with gastric disturbance and occasional traces of jaundice, it is evident that they are producing chronic cholecystitis. They should be surgically removed if the symptoms do not soon clear up under medical treatment. The operation is usually a simple one, and the results extremely good, and the mortality low (about three per cent.).

After the removal of the calculi it is wise to maintain for long the general medical treatment for cholecystitis, for, al-

though stones rarely reform, a degree of catarrh is apt to persist which interferes with the general health of the patient.

BILIARY COLIC.

Here a calculus has left the gall bladder, and, in passing through the ducts, gives rise to spasm and great pain.

Diagnosis.—The agonizing pain, usually accompanied by vomiting and soon followed by jaundice, generally makes the recognition of the condition easy.

Environment.—The patient should be in bed, and kept warm. Often a very hot bath will give some relief, and the heat can be continued by local applications over the seat of the pain.

Diet.—None will be needed during the paroxysm, but the free drinking of hot water is useful, and if it causes or increases the vomiting, so much the better, as the general relaxation which accompanies this act, tends to lessen the spasm of the biliary duct. Some physicians believe that a hot infusion of parsley or other herbs acts better than does the plain water.

Specific Treatment.—If the colic persists for long, the possibility of the surgical removal of the calculus must be considered, but this is a much more serious operation than when the stone is in the gall-bladder, and it is seldom necessary, as, even after hours, the calculus usually passes into the bowel, with complete relief of the suffering.

Symptomatic Treatment.—Heat externally, and as hot drinks, has already been mentioned. The excruciating pain will probably require the free use of morphia, and this should here be combined with atropine, which also tends to relieve spasm. Benzyl benzoate has recently been used a good deal, as a reliever of spasm, and may be tried here. An ordinary dose is thirty minims (of the 20% alcoholic solution) taken in water.

ACUTE CHOLECYSTITIS.

This is due to infection of the gall-bladder, through the blood stream or by the common bile-duct. Gall-stones are fre-

quently associated with it. The symptoms are pain and local tenderness, nausea and vomiting, with usually some fever.

The patient should be in bed, and treated generally as for catarrhal jaundice. Frequently the production of vomiting by the drinking of much warm water gives relief. Hot compresses over the liver are of value. If the pain be great, morphia may be required.

Urotropine, in doses of 5-10 grs. t.i.d., is often given and possibly lessens the infection.

Most cases soon improve, but if the symptoms be severe or prolonged, surgical treatment may be required, although the mortality is here high.

PERITONITIS.

(1) Acute Peritonitis.—Acute inflammation of the peritoneum may be primary, as in the pneumonic form, but much more frequently is secondary to some lesion, inflammatory or perforative, of an abdominal organ, especially the vermiform appendix. The condition is eminently a surgical one and usually requires immediate operation, but, in the absence of skilled surgical help, or until it arrives, something must be done.

The patient, of course, will be in bed, and local applications of heat or of ice are helpful. No food should be given by the mouth and little fluid, but he may suck ice.

Some advocate the free use of saline purges here in the belief that they act as derivatives, but most (with whom I agree) consider them contra-indicated, as they all increase peristalsis, which should above all things be avoided.

The question of opiates is also a burning one. Until the diagnosis is made, and the course decided upon, these should certainly be withheld, but when the case is clear and the patient is waiting for operation, and also in those cases, where for some reason operation is not done, then they should be used, as they not only relieve the pain, but lessen peristalsis, and so induce rest of the inflamed parts. Crile believes that the free use of opium ranks next to operation in the treatment of acute diffuse peritonitis.

Tympanites is often a distressing symptom here, and may

be eased by the use of the high rectal tube; by turpentine enemas, or by the hyperdermic use of pituitrin (15 mins.) or eserine (1/100 gr.). An enema of molasses and milk (1 oz. of the former to 3 oz. of milk) is often very efficacious in relieving abdominal distention.

This subject is further discussed under the heading of appendicitis. (Page 364.)

(2) Chronic Peritonitis.—A chronic adhesive or proliferative peritonitis is very common, but the adhesions that follow acute inflammation are often also included under this term.

In the proliferative type there may be great thickening of the peritoneum, with interference with the functions of the abdominal organs, especially of the intestines. Effusion may be present here, and is often loculated.

In very many cases, peritoneal adhesions cause no symptoms and are only revealed if the abdomen be opened at operation or *post mortem*; but they sometimes are productive of much distress and ill-health through their interference with normal peristalsis.

The Treatment of chronic peritonitis is unsatisfactory. If adhesions cause much distress it may be necessary to separate them by operation. Short of this, Fibrolysin can be injected intramuscularly every second day, in doses of 0.5-2.5 c.c., and has some effect in reducing recent thickenings.

The regulation of the bowels is very important and can usually be best conducted by the use of drugs which act upon the muscular coat of the bowel, such as aloes, cascara and senna. If much fluid be present it must be removed. (*Vide* ascites).

Tuberculous Peritonitis.—The peritoneum is a common site of tuberculous infection. This infection is usually part of a more general one, but may be limited to this membrane, or to it and the mesenteric glands. The condition may be "dry" or "wet."

In the former there is often great proliferation and thickening of the peritoneum with the formation of masses which may mimic solid tumors.

When fluid is present it may be free in the peritoneal cavity or loculated.

There is no form of tuberculosis that has such a natural tendency towards cure as the one under discussion, and this tendency can be increased by proper treatment.

Diagnosis.—This is generally an easy matter, as the symptoms and signs are characteristic, but sometimes in adults the proliferative form may closely mimic malignancy; and when there is effusion it may be difficult to tell the nature of the case. A study of the fluid will assist in this. It may be found to contain tubercle *bacilli*, or if injected into a guinea pig may produce tuberculosis in it.

Environment.—All the environment which is suitable for tuberculosis elsewhere is necessary here (*vide* Tuberculosis), and includes much fresh air, sunlight and, if there be any acuteness, prolonged rest in bed.

Diet.—The patient should be nourished as much as possible, although this is often difficult here as the functions of the alimentary tract are interfered with by the disease. All light foods, such as milk, eggs and nourishing soups and sweets, should be used to the fullest extent. Inunction with cod liver oil is often useful in young patients.

Specific Treatment.—Tuberculin is sometimes of value in these cases, and should be used cautiously, beginning with very small doses. Any decided fever is probably a contra-indication to its use.

Surgical Treatment.—This is more or less radical, but we cannot call it specific, as the cause is not directly removed, but in some unknown way is influenced often for good.

In cases that are not doing well under simple hygienic and other therapy, operation may be resorted to. This usually consists in merely opening the abdomen, and then closing it again, and yet often the case gets better from that time on. This applies specially to the cases with effusion, but in the “dry” ones, it may act just as well. The exact factor that produces the change is not clear. Many think that it is the entrance of air into the abdominal cavity.

Symptomatic Treatment.—Tonics of all sorts are often of use according to the indications. Cod-liver oil, especially, is of value in all cases showing emaciation, and iron is frequently required and the syrup of the iodide is a good preparation

here. The bowels should be kept gently open, but no severe purging is permissible, as it is weakening, and moreover may precipitate involvement of the gut by the tuberculous process. The free painting of the abdomen with iodine often seems useful.

If considerable fluid accumulates it should be removed by aspiration (*vide* Ascites). I recall one case which we repeatedly aspirated, but the fluid always recurred. Finally we replaced this with oxygen, and no more appeared. Some months later the patient died of phthisis and a *post mortem* examination revealed light generalized adhesions of the peritoneum, with no fluid. Possibly the admission of oxygen in the air at operations is an influencing factor. At any rate, the injection of oxygen should be remembered when simple aspiration is not sufficient, as the method is quite simple and free from risk.

ASCITES.

Fluid in the abdomen may be due to many causes, and may be localised here or be only part of a general dropsy. In the latter case the cardiac or renal condition which is probably responsible should be appropriately cared for.

Drastic purgatives, diuretics, sweating and limitation of the fluid-intake have all been advocated for the lessening of the condition, but none of them are of much value, and most of them give much discomfort. When the effusion is only moderate in amount, they may be given a trial, but, if it be sufficient to cause discomfort and any embarrassment of the diaphragm, it should be removed by mechanical means.

Paracentesis Abdominis.—This little operation is done with a trocar and cannula. The bladder should first be emptied. Then, under local anaesthesia and with aseptic precautions, a small incision is made through the skin in the middle line, midway between the umbilicus and the pubes, and the trocar entered through it. It is well to have previously placed a broad bandage round the abdomen, which is tightened as the fluid escapes and lessens the chances of syncope, and also increases the amount of fluid that will escape.

Some prefer the slow way of removing the fluid. This is done with a very small cannula, to which is attached a long rubber tube, and the fluid slowly drains through this into a vessel placed below the bed.

When the cannula has been removed, the opening should be carefully closed with cotton wool and flexible collodion to prevent leakage.

Occasionally, in ascites due to cirrhosis of the liver, tapping is curative, but generally the fluid recurs, and has to be again and again removed. Various operations have been devised for partially re-establishing the flow of blood through the portal system, such as by making an artificial anastomosis between the general circulation and the portal one, and these are sometimes successful.

In syphilis of the liver there may be much ascites, which may clear up under specific treatment.

CHAPTER XXIII.

DISEASES OF THE DIGESTIVE SYSTEM.

DIARRHOEA. MUCOUS COLITIS. CHOLERA. DYSENTERY. DIARRHOEA IN INFANTS.

DIARRHOEA.

Anything which increases peristalsis or intestinal secretion will tend to cause diarrhoea.

We may classify all diarrhoeas into three groups as follows—

(1) Nervous, (2) “Purgative” and (3) Inflammatory.

(1) In the nervous type, peristalsis is chiefly affected, and the normal contents of the bowel are hurried on quickly, and reach the lower gut in too fluid a condition and too large an amount.

(2) The “purgative” class is a large one and includes diarrhoeas produced not only by medical purgatives, but also due to foods and drinks which contain purgative materials. These materials may be an essential part of the food, as in the case of fruits, etc., or may arise from fermentation or bacterial action before the food is swallowed, as is the case in ptomaine poisoning or from such after ingestion.

These purgative substances do not necessarily or even ordinarily produce inflammation of the mucous membrane, but merely act, as do any medicinal purgatives, by increasing peristalsis or secretion.

Diarrhoeas of this group are usually rapidly relieved by purgatives, which assist Nature in getting rid of the offending material.

(3) In the third class, catarrh or ulceration of the bowel exists, and the resulting diarrhoea is apt to be more persistent, although, when the cause of the inflammation is removed, it tends to disappear.

To put the matter in another way, it may be said that diarrhoeas are either functional (and the nervous and “purga-

tive" types come under this heading), or organic, which comprises the third class, where some demonstrable change exists in the lining of the bowel.

Thus, it will be seen that diarrhoea and enteritis are very different things, and yet they are very frequently confounded.

Therapeutically, it is important to know what part of the bowel is irritated or inflamed, as the treatment varies accordingly. Roughly speaking, we can divide the alimentary tract into three parts: the first consisting of the stomach and duodenum: the second of the small and the upper part of the large intestine, and the third of the lower portion of the large bowel.

Irritation of any of these parts produces characteristic symptoms. Thus, when it is in the uppermost portion, epigastric discomfort, nausea and vomiting will occur: when below this, diarrhoea is set up, but the type of the purging is different when the trouble is in the middle segment of the tract from what it is when it is in the lowest. In the former, the stools tend to be fluid, bulky and evenly mixed, and rarely show any blood, and their passage is followed for a time by a sense of relief. There is usually griping. In diarrhoea of the lower type the stools are scanty and often contain blood and much mucus, and there is straining and tenesmus so that the patient is not at once relieved by their occurrence.

The diarrhoea occurring in typhoid is a good example of the upper type and that in dysentery illustrates the lower form.

Diagnosis.—From the above outline of the different forms of diarrhoea it will be evident that before any treatment be attempted the type of the condition should be ascertained and also the portion of the alimentary tube affected. The treatment will vary accordingly. Thus, purgatives are useless in the first (nervous) class, are sometimes harmful in the third (organic class) and are usually strongly indicated in the second or purgative varieties. There are, of course, exceptions to this general rule.

A watery diarrhoea often occurs in cases of failing circulation with dropsy, and is due to the venous engorgement of the intestinal mucous membrane, and hence belongs to our

third type. As a rule it is beneficial and should be encouraged rather than checked.

Environment.—In all acute diarrhoeas the patients should be in bed. In the slighter and more chronic forms this is not necessary, although, generally speaking, it is always easier to successfully treat a case when he is in bed, and hence, even in slight chronic cases that are resisting treatment, it is often well to insist on bed until the condition is relieved: exercise and chills so much excite peristalsis. In the East, residents soon find how chills of the abdomen produce diarrhoea, and they are careful to wear protecting belts. The Indian native wears a long cloth as the pugaree by day to protect him from the rays of the sun, and at night winds the same cloth round his waist to ward off abdominal chills.

In all acute diarrhoeas heat to the abdomen is of value, best in the form of frequently changed hot-compresses. If the pain be great the counter-irritant action of this may be enhanced by the use of turpentine sprinkled over the surface of the compresses before application, or by the use of mustard poultices.

Diet.—The diet in diarrhoeas is a very important matter. Generally speaking, in acute cases this should be much restricted and if necessary altogether withheld for a day or two. Boiled milk and things made with boiled milk, such as arrow-root, sago and well-boiled rice and tapioca, all tend to constipate and may be cautiously given as the flux lessens. All food leaving much *débris* should be withheld. In chronic cases milk should still be the staple diet, and the patient should avoid raw acid fruits, nuts, all fatty dishes, and large quantities of fluid, especially iced drinks.

Specific Treatment.—The removal of the cause is often possible, especially in the second group, and when this has been done the looseness will tend to disappear. Most of this class will be cured by a single dose of castor oil. Castor oil, it is well to remember, owes its purgative properties to ricinoleic acid. This is not present as such in the fresh oil, but is set free in the duodenum by saponification. If any of this change has taken place before the oil is swallowed, it will irritate the stomach and is also much more unpleasant to the taste.

Apart from the action of its purgative principle, castor oil has a soothing and emollient effect, and thus produces an after sedative action following the purgation. The oil acts chiefly on the small intestine, but, to a lesser extent, on the large as well.

An ordinary dose is a tablespoonful, and it can be well administered in milk or cream, or can be given in capsules: Infants do not resent the taste as much as do older people. In severe diarrhoea it is well to "guard" the oil by adding 10-20 mins. of laudanum, which increases the after-sedative effect.

Other purgatives may be used here, but none are as good as castor oil for sweeping out the contents of the whole intestine, and at the same time producing an after-soothing effect.

Intestinal Antiseptics are sometimes of value when there is intestinal infection and they will at least lessen the foetor of the stools.

Salol is probably the most used, in doses of 5-15 grs t.i.d., or Beta-naphthol (3-10 grs), but many others are occasionally preferred. Calomel, in frequent minute doses, is a powerful antiseptic here.

Recently Dimol has been much used and appears to be very effectual. It is 35 times as strong as phenol and yet is non-toxic and all can be recovered from the stools. The formula is $C_6H_2(CH_3)_2(OCH_3)OH$. The dose is 2-4 grains by mouth t.i.d. after meals.

Symptomatic Treatment.—All agents which lessen peristalsis, and ones which check intestinal secretion, will tend to stop a diarrhoea.

(a) in the nervous type of the trouble bromides are useful, and also psychic treatment, the patient being urged not to easily yield to the demand of his bowel for evacuation. He can often thus conquer what has become a bad habit, which may have been started from some real cause and afterwards continues.

In Lienteric diarrhoea, where the bowels tend to act as soon as food is taken, there is increased peristalsis, and undigested food appears in the stools. The patient should rest after meals. Bromides are often useful and sometimes small doses

of *liquor arsenicalis* taken before food assist, in some obscure manner.

Opium will generally check nervous diarrhoea but for obvious reasons should not be used if it can be avoided.

(b) In the "purgative" type of diarrhoea, a therapeutic purge with castor oil is often all that is required, as, when the offending agent, whatever it be, is removed the looseness of the bowels disappears. Sometimes, however, the irritation has been sufficient to cause some catarrh, and then the case has drifted into the third class and will require corresponding treatment.

Also, in some cases, the effect of the offending toxin is very severe (as in ptomaine poisoning) and the diarrhoea may have to be controlled by astringents or by opiates. Opium by the mouth has the most powerful action in controlling peristalsis, but if there be much vomiting then it may be necessary to give morphia hypodermically. In severe cases of ptomaine poisoning general stimulents may be required to lessen the collapse.

(c) In the third type of diarrhoea, where catarrh or ulceration exists, much treatment is often necessary, especially in the chronic cases. To begin with, a dose of castor oil is often advisable to clear away any offending material, and then bismuth and chalk are our stand-bys and such a mixture as the following will usually be found to answer well:—

℞ Bismuth. Carbonat.	ʒij.
Pulv. Tragacanth. Co.	ʒj.
Mistur. Cret.	ad ʒvj.
M.	

Sig.—A tablespoonful as often as required.

This may be given as often as there is a loose stool, and thus the dose is regulated according to the severity of the condition. If the diarrhoea persist, or if it be severe from the first, an opiate can be added to this mixture, such as the *tinctura camphorae composita*. This contains about two grains of opium to the ounce, in addition to aniseed and camphor, and is thus both sedative and carminative. It may be added to the extent of 10-30 mins to each dose.

Various intestinal Astringents are often used in diarrhoea and are occasionally of some value, but their effect is limited.

Tannic acid or gallic acid are the cause of the astringency in all vegetable astringents and, when either reach the stomach in which there are any contents, they promptly combine with the alkalies or proteins there and thus for a time lose their astringency. The compounds so formed undergo digestion and the acid is again liberated and exerts some astringent action upon the upper part of the intestine, until it again combines with the bowel contents.

Tannic and gallic acids are hence of some value in diarrhoea due to irritation high up in the alimentary tract, but are of little or no use in the lower ones. If the acid be given in keratin-coated capsules it will pass through the stomach unchanged and hence act more powerfully in the intestine.

The vegetable astringents do not produce vaso-contriction.

The dose of tannic acid is 2-5 grs, and of gallic acid, 5-15 grs.

Kino (dose 5-20 grs.) and *Catechu* (dose 5-15 grs.) may be similarly used. The tinctures of these are frequently added to diarrhoea mixtures.

There are several non-official combinations of tannin and albumen which are unaffected by the gastric contents and yet become active in the alkaline contents of the intestine. The best of these is probably Tannalbin (5-15 grs) or Tannigen (5-10 grs.) They are both insoluble in water but may be added to the above mixture, and so suspended, or may be given alone.

The metallic astringents are often used in diarrhoea, especially lead acetate and perchloride of iron. They precipitate albumen and so protect the mucous membrane. Their action, as in the case of the vegetable astringents, is largely on the stomach, unless, indeed, they be given in pill or capsules coated with keratin. The lead and opium pill is a very powerful remedy in diarrhoea, combining the astringent action of the lead with the sedative one of opium. The dose is 2-4 grs, and a four grain pill contains 3 grs of acetate of lead and 1/2 gr. of opium. The pill is much used in the Tropics and many people carry them along with their quinine.

In severe diarrhoeas, such as sometimes occur in typhoid fever and in tuberculous ulceration of the bowel, these remedies may have to be tried one after the other, and occasionally even opium will not control the flux.

In giving any drugs by the mouth in the treatment of intestinal conditions it is well to administer them two or three hours after meals so that they will sooner pass on into the bowel.

In catarrh or ulceration of the lower part of the large bowel astringent and other remedies by the mouth are of very limited service. Colitis is more amenable to local applications from below.

In acute conditions of the lower bowel the suffering and tenesmus is very great and nothing gives such quick relief as the *Enema Opii*, which is not official (there are no official enemas in the B.P.) but occurs in many hospital pharmacopoeias. The usual one is made by adding 30 mins. of laudanum to 2 ozs of warm mucilage of starch. It should be injected into the bowel very slowly. The relief given is very great. One poor fellow told me it made the difference to him between Heaven and Hell! Opium by the mouth or morphia hypodermically do not act so quickly or so well here. Often, in slighter cases, the starch mucilage may be used alone with a good deal of benefit.

In more chronic cases rectal lavage is frequently indicated. A good solution for this purpose is simple normal saline, or we can employ an astringent one, such as silver nitrate in the strength of 1/4-1 gr. to the ounce, or a one per cent. solution of zinc sulphate or of acetate of lead. Or various antiseptic solutions may be used, such as salicylic acid (5 grs to the ounce), boracic acid (10 grs to the ounce) or creolin, in a solution of 1%. As large a quantity as possible should be very slowly introduced and retained in the bowel as long as practicable. The injections may be repeated once daily (or even oftener at first) and then less frequently.

In a few cases of very long-standing colitis it may be necessary to perform an appendicostomy, and then wash the bowel from above. I have on several occasions seen this completely successful when all other measures had failed.

Occasionally one sees a chronic diarrhoea of this lower type produced by the presence of hard scybalous masses and the treatment is evident once the cause has been discovered.

It is a good clinical rule always to do a digital rectal examination in a case of chronic diarrhoea of the 'lower' type.

MUCOUS COLITIS.

This disease is a nervous rather than an inflammatory one, and is characterized by the frequent formation and throwing off of a membrane, or of masses, of a greenish-white substance, consisting chiefly of mucin. The attacks are accompanied by much colicky pain, which is relieved by the passage of the membrane. The condition occurs nearly always in nervous women, who usually show other signs of neurosis as well.

The treatment consists in building up the nervous system in every possible way. The diet should be liberal. Exercise in the open air or massage are valuable. Local treatment of the bowel by lavage and the use of various astringents and antiseptics has been much advocated, but are of doubtful value, and they all tend to fix the patient's mind on the local condition too much. Constipation is frequent and should be relieved by non-irritating laxatives, such as cascara, senna or aloes or by the use of liquid paraffin. Often enemata of soap and water are the most satisfactory method of moving the bowels here.

During a paroxysm, the patient should be in bed and the abdomen fomented with hot cloths. Opium or morphia must not be used if possible, but the bromides are of some value.

After some time, it may be years, the condition usually completely disappears.

Mucous colitis is a peculiar disease which has increased in recent years, and (as Osler said) "has become the fashionable complaint, displacing neuritis to a large extent."

ASIATIC CHOLERA AND CHOLERA NOSTRAS.

Asiatic cholera is a terrible disease when it occurs in epidemic form. It is associated with a profuse watery diarrhoea which rapidly depletes the system. A clinically similar con-

dition occurs in temperate climates (*cholera nostras*) although the essential cause is different. True Asiatic cholera has occasionally invaded Western countries but has never gained the foothold there that it has in the East.

The infection is from the "comma bacillus" which invades the intestine and poisons by its endotoxin. It is almost entirely water-borne and attendants upon cases seldom take the disease.

Diagnosis.—During an epidemic of true cholera the diagnosis is only too easy, but many slight cases then occur to which the name of Cholera is often applied. Sporadic cases must be distinguished from cholera nostras and also from diarrhoea due to ptomaines, arsenic, corrosive sublimate and certain fungi. In doubtful cases the finding of the comma bacillus in the stools may be conclusive.

The suddenness of death in true cholera is sometimes appalling, and in India I have seen patients succumb in a few hours.

Environment.—In Asiatic cholera the patient should be isolated and all excreta destroyed. His body heat should be maintained by surrounding him with hot bottles.

Diet.—During the acute stage nothing can be given by the mouth, except perhaps water, whey or egg albumen. As mentioned later, intravenous injections of saline or glucose are of value.

Specific Treatment.—Inoculation by either Haffkine's or Kolle's methods has proved of some protective value to communities during an epidemic, but the reaction is apt to be severe. Serum treatment has been tried but the results are not very convincing.

Symptomatic Treatment.—Early in the disease it is well to give a dose of castor oil, well guarded with laudanum—for example, half an ounce of the former with 20 mins. of the latter. Some prefer a small dose of calomel.

The opium should be freely continued if there be much abdominal pain, which is very frequent, but in the stage of collapse it should only be used very cautiously. If vomiting be present, morphia may be substituted and given hypodermically.

Permanganate of potash in doses of 2 grains has been a good deal recommended.

Stumpf claims a great reduction in the mortality from cholera in Servia through giving by the mouth or administering by the bowel large amounts of suspension of Kaolin in water. R. R. Walker¹ has recently confirmed the value of this method. The kaolin is suspended in an equal bulk of water and the patient drinks this freely. Also, in unconscious cases, it may be used as a thick suspension *per rectum*. The drug appears to act both mechanically and as an absorbent of toxins. It has no direct effect upon the cholera vibrios.

Some use saline, or astringent (such as 2% tannic acid) rectal injections and they undoubtedly, at least, supply fluid, of which the body is so much in need.

Intravenous hypertonic saline injections are of great value, and three or four pints of this may be slowly given at once, and the effect is often marvellous in reviving, at least for a time, an apparently moribund patient; and Rogers of Calcutta has shown a great reduction in the mortality from the systematic use of this.

Uraemia is not uncommon in the last stage of cholera and may (according to Rogers) be largely prevented by the intravenous injections of sodium bicarbonate and dry-cupping over the loins.

In the collapse, strychnine should be freely used and adrenalin may be given.

DYSENTERY.

This is one of the diseases that haunts the tracks of war, but it is endemic in tropical and subtropical countries and is a frequent source of mortality and disability there.

There are two great classes of dysentery, the amoebic and the bacillary, the symptoms of which are very similar, and the differentiation must depend largely upon the laboratory findings. But there is danger in waiting for the results of bac-

¹*Trans. Royal Soc. of Medicine*, October, 1921.

teriological examinations of the dysenteric stools, and, as Duncan Graham¹ has pointed out, by paying attention to the characters of the predominating cells in the mucus, the nature of the case can usually be determined.

(1) Acute Dysentery.

Diagnosis.—The frequent tenesmic stools, containing blood and mucus, are characteristic, and there are general symptoms of infection, such as fever and toxæmia.

Environment.—The patient should be isolated and all excreta carefully disinfected and destroyed. He must be kept in bed as long as any acuteness remain.

Diet.—This should be light and consist largely of materials that leave little débris. At first there is often a good deal of nausea and very little food should be given, but such things as egg albumen and whey may be borne. Then milk, best boiled, should be our mainstay and we can add milk soups, finely-divided, thoroughly-cooked vegetables and carbo-hydrate materials, such as arrowroot and the like.

Specific Treatment.—(a) In the amoebic form, Ipecacuanha, or its active principle, emetine, is a specific. Emetine is usually given hypodermically in doses of $\frac{1}{3}$ gr. thrice weekly, but in acute cases as much as 1 gr. may be given morning and evening for a few doses. There is some tendency lately to go back to the use of ipecacuanha itself. This contains cephaeline as well as emetine which may help to explain its better action. The powdered ipecacuanha may be given in twenty grain doses, mixed with jam or syrup. The patient is in bed, and half an hour before the administration is given 15 mins. of laudanum. Then a mustard leaf is applied to the epigastrium and the drug is given. Thus administered, it seldom produces vomiting. Or the drug may be given in keratin-coated pills, each containing 5 grs. Given in this way, it passes through the stomach without causing any irritation there. Occasionally, if vomiting be severe, it may be given through a small tube into the bowel. The ipecacuanha should be repeated once or even twice daily as long as there be any acuteness. Much larger doses than this are often used. Thus, A.

¹*Lancet*, January, 1918.

C. Reed¹ gives a single dose of 90 grains which may be increased to 120 grains. This is repeated daily for not more than five days. A sign of improvement is the appearance of faeces in the stools, which before have consisted entirely of mucus and blood and débris.

The systematic use of ipecacuanha or emetic greatly reduces the percentage of occurrence of liver abscess.

(b) In the bacillary form there are two methods of treatment which may be looked upon as specific. (1) The use of frequent doses of salines. The best saline here is probably sodium sulphate, given in doses of one or even two drachms every two hours at first, and then less frequently as the stools become feculent.

(2). The injection of the appropriate serum. A number of strains of the Shiga and Flexner bacilli occur and a polyvalent serum is usually used. 20-50 c.c. of this is given intramuscularly as often as once daily at first. Even double this dose has been used in urgent cases, and it has been given intravenously.

These two forms of specific treatment may well be used in the same case.

The value of rhubarb in acute bacillary dysentery has been urged by R. W. Burkitt.² In Nairobi he has used nothing else for three years. The dose is half a drachm of powdered Turkish rhubarb (*pulv. rhei rad.*) every one, two or three hours until the rhubarb appears in the stools. Major H. C. Brown³ has recently shown that the drug has no action on the bacilli so the explanation of its good effects is not clear. It is an example of rational empiricism.

Symptomatic Treatment.—Heat to the abdomen in the form of frequently renewed hot compresses should be used. If there be much pain morphia may be indicated.

In the acute amoebic form local treatment is not of much value, but in the bacillary type it is often useful, and gentle high rectal douches, with normal saline or a one-per-cent. solution of bicarbonate of soda, are valuable and often give

¹*Amer. Jour. of the Medical Sciences*, October, 1922, p. 587.

²*Lancet*, June 30th, 1921, p. 254.

³*ibid.*, February 24th, 1923.

much relief. Ballmann strongly advocates the use of a 1% solution of tannic acid and says that it quickly lessens the tenesmus.

The opium enema is here of great value. It contains 30 mins of laudanum in 2 ozs of mucilage of starch. Later on, solutions of boracic acid or alum may be substituted.

(2) Chronic Dysentery.

(a) Amoebic form. Sometimes this may persist for years, very especially if not specifically treated. A case of this kind is mentioned below. Besides careful dieting, and rest suitable to the condition of the patient, emetine should be given. This may be used hypodermically in doses of $\frac{1}{3}$ gr. every day for some weeks, or emetine-bismuth iodide may be given by the mouth in doses of 3 grs. daily for 12 days, and in relapsing cases even for 24 days. Or a combination of the two methods may be employed.

One grain subcutaneously every day for 12 days will cure most cases of amoebic dysentery, though some give half a grain by the mouth as well, in coated pill form, making a total of 18 grains. If amoebic cysts are found afterwards the course should be repeated after an interval of a month.¹

Locally, enemata of antiseptics are valuable and, of these, quinine, in a solution of 1:5000, has the most effect upon the amoebae. It should be gradually increased in strength up even to 1:500.

Liver abscess is a not uncommon complication of chronic amoebic dysentery. As soon as detected it may be opened and drained and the abscess cavity washed out with quinine solution, and emetine given hypodermically. Aspiration and emetine are often sufficient and if necessary some form of syphon drainage may be used. The prognosis is wonderfully good. Abscess may occur years after the acute infection was present, as in the case of a soldier seen in the first year of the war. This man had been invalided from India five years before on account of dysentery. He returned to his employment in a lead-works and for five years had no diarrhoea but several slight touches of plumbism. Six weeks after enlisting, the dysentery broke out and soon he developed liver abscess, for

¹Chopra & Ghosh. *Indian Medical Gazette*, July, 1922.

which he was operated upon and recovered. It seemed here as if the lead had held the dysentery in check for years, and when this was stopped (by his enlisting) the trouble appeared again, so that the infection had been latent all those years.

(b) Bacillary form. This is sometimes very persistent. It is well to put the patient to bed and on a milk diet. He is much more likely then to improve than if he be going about. Sera are of little value at this stage, but a sensitized auto-genous vaccine may be tried. The first dose should be small—say 5 millions. Medicines by the mouth are not of great value here, but courses of sodium sulphate, as above described, may be tried. The treatment is chiefly local, and consists in daily irrigation of the colon and rectum with some antiseptic or astringent solution. Silver nitrate is most commonly used, beginning with a strength of 1:5000 and gradually rising to even 1 per cent., or protargol, 1:100, may be employed. Simple normal saline irrigations often do very well and give less distress than the more medicated ones. A 5% solution of boracic acid is often efficient.

Possibly, in a very obstinate case, appendicostomy might be done, with irrigation of the bowel from above.

DIARRHOEA IN INFANTS.

This condition is responsible for most of the deaths amongst babies under two years of age and hence the subject is one of great importance. Naturally it occupies much of the attention of the paediatrist and is only touched on here by a few general remarks.

Diarrhoea is usually a disease of artificially-fed infants, and, if only mothers could or would always nurse their infants, most of it would be avoided and the saving of life to the nation would be great.

Defects in the food-supply, either in quantity but chiefly in quality, are the chief sources of the trouble. The disease is largely one of the Summer months, when milk is most apt to “go wrong” and also bacterial growth is most active. The organisms found in the intestine of a healthy milk-fed infant are mostly the *bacillus lactis aërogenes* in the upper bowel and

the colon bacillus in the lower. But, in disease, many organisms invade the bowel, chiefly of the "acid" type, but also the Shiga bacillus and allied forms occur. An enteritis is eventually present, but at first there may be little change in the mucous membrane, and the diarrhoea is of the "purgative" type.

The symptoms vary with the acuteness of the infection and with the part of the alimentary tract specially involved. Thus, when the upper part is chiefly affected, vomiting will be a prominent symptom; while, when the lower portion is attacked, tenesmus with mucous and bloody stools will be present.

To the very acute form the term Cholera Infantum is applied, and the symptoms closely resemble those of Asiatic cholera, and in a few hours the infant may be collapsed, with sunken fontanelles and profound prostration.

Preventive Treatment.—The majority of these cases can be prevented. Where possible, the mother should nurse her infant entirely, or, if she cannot do this, then at least partially. Formerly it was believed that an infant must either be entirely on the breast or not at all, but this view has now been completely abandoned and it is considered that even an occasional or a partial breast-feeding is better than none at all.

Often for such partial feeding one of the artificial foods, such as Allenbury's, is of great value. Also for railway journeys and other travelling this should be remembered, as also whenever the milk supply is doubtful. It does a child no harm to be entirely on artificial food for a few days.

A wet-nurse is the best substitute for the mother.

In the artificial feeding of infants the greatest care must be taken to keep the bottles and the nipples aseptic. This can be done by frequent boiling, and by then keeping them in a saturated solution of boric acid, which should be washed away before use. The long tubes connected with bottles are now never seen, and just as well as they were a source of much infection.

All food should be sterilized or at least pasteurized before being used.

The subject of the artificial feeding of infants is a very special one and cannot be entered upon here. The different

methods include the employment of (1) diluted or modified cow's milk, (2) percentage feeding, (3) the use of undiluted cow's milk and (4) substitutes for cow's milk.

Every element in the artificial food of infants has in turn been blamed for the occurrence of alimentary disturbance. Thus, for long, the curd was believed to be the chief cause and the so-called "curds" in the stools were shown as evidence of this, but it was found that these were largely soluble in ether and hence were really fat. Next the fat was inculcated and then the sugar.

Finally, the dilution of the mixtures was pointed out by Budin to be the chief cause of the trouble and he fed infants even from birth on pure cow's milk, merely heating this in a water-bath for two hours to completely sterilize it, and his results were wonderfully good. The method was tried at the Sick Children's Hospital in Edinburgh, and Fowler reported that he got better results from it than from any other system of artificial feeding and my experience at the Children's Hospital here was of the same nature. This always in infants who had not as yet any serious intestinal disturbance.

An infant requires a certain number of calories in the twenty-four hours and it should be ever borne in mind, when the diet has to be temporarily reduced for some reason, that as soon as possible it must be got back to a living amount. This essential fact is sometimes lost sight of, and an infant, with some indigestion or diarrhoea, is too long left upon an insufficient diet, and gradually loses ground, not so much from the disease as from the paucity of the food given.

Diagnosis.—A diagnosis of vomiting and diarrhoea is of course not a sufficient one and the exact nature of the condition must be studied in every possible way. The general symptoms, the state of the stools and the bacterial findings in these, will all help in the investigation.

Environment.—This is largely preventive and includes abundance of fresh air, night and day, sensible clothing and great cleanliness. Intestinal conditions are closely connected with climate, and often a child that is not doing well may improve from a complete change of air, especially to the country or to the seaside.

During the illness the infant should be kept warm, and in states of collapse this is specially important.

Diet.—An intestinal disturbance in an infant suggests an alteration in the diet, usually in the direction of making this, for the time-being, weaker in strength and less in quantity. In acute cases it may be necessary to completely stop all food for a day or two and only give sips of water or whey or albumen water. Then milk can be cautiously commenced again, diluted and boiled. If this does not agree it may be peptonized or variously changed by the percentage method, or protein milk may be used. It may be necessary sometimes to stop milk altogether and for a time resort to one of the artificial foods such as Allenbury, Benger or Horlick's malted milk. These foods should all be looked upon as temporary expedients, but as such they have their place. In collapsed cases a few drops of brandy are often of value.

Specific Treatment.—Castor oil may almost be called a specific treatment here, in that it sweeps out a large amount of the offending culture of bacteria and the irritating bowel contents. It may be given in a single rather large dose of a teaspoonful, or often well as small doses repeated thrice daily. Fortunately infants seem to resent the taste of the oil very little.

Intestinal antiseptics may be used, such as salol and betanaphthol, but their action is on the whole disappointing. Perhaps the best is minute doses of calomel (say $1/12$ gr.) combined with 2 grs. of sodium bicarbonate and given every hour until half a grain has been given. It should be followed by a small dose of castor oil.

Symptomatic Treatment.—If nausea be marked, gastric lavage is invaluable. It is easily done in infants through a soft catheter. Normal saline is a useful solution to use, or a weak one of bicarbonate of soda. (1:100).

In cases showing involvement of the lower bowel, rectal irrigation with sod. bicarbonate (1 dr. to the pint) or normal saline, is very useful and may be gently done with little distress to the patient.

As a rule, bismuth is valuable in all catarrhs of the alimen-

tary tract and the mixture mentioned on page 325 may be given in doses of half to one teaspoonful.

Opium is badly borne by infants, but in minute doses, is sometimes life-saving. A child of one year may have $1/100$ gr. of morphia hypodermically if the symptoms are very acute, and short of this the addition of small doses of paregoric to the bismuth mixture is often effectual in controlling the flux.

Where there is collapse, stimulants must be used, either alcohol or strychnine, or others as indicated.

In severe collapse, the intravenous administration of normal saline, or a 30% solution of pure crystallized glucose in distilled water may be employed and 50-100 c.c. should be given, always very slowly. Occasionally life may be saved in an apparently hopeless case by a timely transfusion of blood.

CHAPTER XXIV.

DISEASES OF THE DIGESTIVE SYSTEM.

CHRONIC CONSTIPATION. APPENDICITIS. INTESTINAL PARASITES.

CHRONIC CONSTIPATION.

Chronic or habitual constipation is perhaps the most common ailment to which mankind is subject. Vast numbers of people may be said to take their point of view of life from the state of their bowels. If they happen to remember that the bowels have not moved on any particular day, the outlook is gloomy, while, if this function has been satisfactorily performed, all is well. If, however, they should chance to forget the omission, in most cases, they will feel no ill effects. The conclusion must be that the result is largely psychic.

To attain the desired regularity the laity resort very largely to medicines, and the amount spent yearly upon these must be enormous.

There has lately been a great wave of medical opinion against such wholesale use of laxatives and some physicians have gone so far as to declare that practically all cases of chronic constipation can be permanently cured without them by psychic means alone. The idea, however, is not a new one and Trousseau was a strong advocate of it and wrote that, "the will, patiently and regularly applied, will often triumph over this infirmity." A few years ago, Dr. Lyon, of Buffalo, stated before the Association of American Physicians that he had cured 68 out of 69 cases solely by this method.

When aiming at any object it is necessary to have the goal clearly in view, and the question naturally arises as to what is the normal as regards the evacuations of the bowels. The general and probably correct view is that they should move once daily; and in India this has been raised to a religious pitch, and one may see a high-caste Hindoo wearing his sacred

cord over the left ear until his bowels have moved for that day. While he thus wears the caste symbol he is "unclean," and hence a powerful and usually successful psychic impulse towards regularity is constantly furnished to him.

But the frequency with which the bowels move is not a hard and fast rule, and one often sees people not relieve themselves more than every second or even third day, and yet seem to be in perfect health. On the other hand, some persons appear to require that their bowels move twice each day. One might define chronic constipation as a state in which the bowels are moving less frequently or less thoroughly than is the custom of the individual under consideration.

Cases of chronic constipation may be classified in different ways. A. F. Hurst, who has studied the movements of the alimentary tract by the aid of bismuth meals and the X-rays, would put them all under two headings, viz.: (a) those, he called intestinal constipation, in which defecation is normal but the passage through the intestine is delayed; and (b) those cases, called ones of *dyschezia*, where there is no delay in the arrival of the faeces in the pelvic colon, but their final expulsion is not adequately performed. In normal people, according to him, the rectum is usually empty, and, when the faeces enter it from the pelvic colon, a sensation is at once produced from the stretching of the muscular walls of the rectum which is interpreted by the brain as a desire for defecation. If the desire be resisted, very soon the rectal wall relaxes and there is no longer the same tension, and thus the sensation disappears, although the contents are still in the bowel. Hurst has shown by experiment that even in the most severe cases of chronic constipation of his second class, the muscular sense is not dulled, and, if a pressure of say 50 mm. of mercury be artificially produced in the rectum by the inflation of a rubber bag placed there, the desire for defecation is as easily set up as in the normal. The trouble is that the tone of the bowel has been diminished, so that it takes a great bulk of contents to produce the necessary tension.

Diagnosis.—From a therapeutic point of view, one may conveniently group all cases of chronic constipation under the following headings according to their causation, and before

undertaking the treatment of a case it is well to try and find out to which type the condition belongs.

Classification of cases of Chronic Constipation.

1. Bad habit.
2. Diet errors.
 - (a) Not enough indigestible material, such as cellulose.
 - (b) Insufficient water.
 - (c) Astringency.
3. Too complete absorption of water, due to—
 - (a) Exercise.
 - (b) Sweating.
 - (c) Urination.
4. Deficiency of intestinal, biliary and pancreatic secretions.
5. Loss of tone of the muscular wall of the bowel.
6. Obstruction, due to—
 - (a) Foreign body, hard faeces, or tumour in or pressing upon the bowel.
 - (b) Spasm of the wall of the bowel.
 - (c) Paralysis of a portion of the gut. (Such a local paralysis will sometimes produce a very complete obstruction).

In chronic constipation very often several causes are at work in the same case. For instance, an individual may have acquired the bad habit of not going regularly to stool, may take an insufficient amount of fluids and may have a hypotonic bowel.

Environment.—Regular exercise is very essential in these cases. Many healthy men find that when they are out on a survey, or have other hard exercise, their bowels are regular, while when living more sedentary lives they suffer from habitual constipation. All the same, exercise, in excess, can have the opposite effect and athletes frequently are constipated, probably because their absorption of water from the bowel is so active.

Massage takes a second place to natural exercises here, but abdominal massage is sometimes very valuable.

The patient should be enjoined to go regularly to stool, and this at a fixed hour every day, best after a meal. If not successful then, I believe it is better to miss that day altogether and wait for the same hour of the succeeding day. The bowel can thus be trained to act rhythmically. After an individual has taken a laxative, this periodicity is for a day or two disturbed, and the patient should be told that after the action of a purgative, it is natural that his bowels should not move for a while. Otherwise he is only too apt to repeat the purgative and thus drift into the bad habit of constantly taking such medication.

Diet.—The diet should be one that provides much *débris*, and thus ought to consist largely of vegetable materials. Porridge, brown bread, uncooked vegetables and fruit are specially useful, but cooked vegetables and fruits are also of value, especially prunes and figs. Bananas are rather constipating. Milk, especially boiled milk, and most farinaceous foods, are rather binding and should be taken only in great moderation. Strong tea is astringent, the least so being China tea.

Fluids should be freely used and are specially indicated when excessive sweating, from exercise or disease or increased urination, has produced an undue absorption from the bowel. Lipowski noted that a normal individual could retain his intestinal contents for one or even more days beyond the usual without any alteration occurring in their consistency, while in the case of the constipated they become hard and dry. This is due to an abnormal degree of absorption. He found that such absorption could be largely prevented by the injection of liquid paraffin into the bowel.

In most cases a tumblerful of cold, or hot, water, taken night and morning, is useful. The common fear that water, taken with meals, dilutes the gastric juice, has little foundation in fact. It often acts rather as a stimulant to secretion.

Specific Treatment.—In going into the history of these cases we may often find a removable cause, and by treating this may soon relieve the condition.

Often the patient has got into this state through bad habit or through relying upon laxatives: the diet may be the cause, either on account of its insufficiency of débris, or because it contains some astringent, as where tea is too often indulged in: the liver may be "sluggish," and so on.

Symptomatic Treatment.—In the majority of these cases we can, by enjoining regular attendance at stool, the taking of a plain, bulky and non-astringent diet with lots of water, and the use of plenty of exercise, completely cure the condition. But in many instances we will require, for a time at least, the aid of some drug in our endeavor to establish the regular habit of the bowel.

Drugs act here in two ways—either by increasing the watery contents of the intestine, so that these become more bulky and less hard; or else they stimulate the muscular wall of the bowel to better tone and contraction. The various Salines act by increasing the fluid contents of the intestine, chiefly by osmosis. The cathartic action of an *ion* of a saline depends upon the time required for its absorption. Either the *kation* or the *anion* may act. For example; in sodium sulphate, the *kation*, sodium, is quickly absorbed while the sulphate *anion* is not, and hence the purgative action depends upon the latter. On the other hand, in the case of magnesium chloride, the *kation* is slowly absorbed while the *anion* is quickly taken up and so the purgative action of the salt depends upon the *kation*, magnesium. In magnesium sulphate we have a salt in which both *ions* are only slowly absorbed and hence theoretically the salt should be an active purgative, and such is the case.

The salines have little stimulating action on the secretion and almost none on peristalsis. Their total effect is to increase the fluid contents of the large bowel. They do not purge well when the patient is in bed, as the stimulus of movement is required for the increase of peristalsis.

The moderate habitual use of salines is often very useful in the aged, but here they should be given combined with some aromatic, as otherwise the patients feel them, as they express it, "cold on the stomach."

All salines act in much the same way, and it is a good plan

to vary them, when, for any reason, they have to be taken for long periods. They should be given well diluted with water on first rising in the morning. It is worth noting that Macht¹ has shown that saline purges interfere with the absorption of nearly all drugs given with or after them. Probably they will also inhibit in the same way the absorption of intestinal toxins which may partly explain their value in many cases.

Most of the vegetable cathartics, in medicinal doses, chiefly act by increasing peristalsis, and thus hurrying on the contents of the bowel. In the very numerous cases where the constipation is due to want of tone and contraction of the muscular coat of the intestine, these drugs are of value. The ones most commonly used are Senna, Aloes, Rhubarb and Cascara. They are all apt to gripe, and hence belladonna or hyoscyamus are usually added, as they tend to lessen this unpleasant effect. With care, these vegetable aperients may be gradually reduced while the good effect remains. A mixture like the following is frequently useful, and the doses may be steadily lessened to the vanishing point.

R	Extracti Cascarae Sagradae Liquidum	℥ j
	Tincturae Hyoscyami	℥ ij
	Glycerini	ad ℥ iij
	Misce.	

Sig.—60 drops in water regularly at bedtime.
Gradually decrease the dose.

Sulphur is much used in chronic constipation, especially in children and in patients suffering from haemorrhoids. It produces a soft, formed motion, without griping or other objectionable features. The official lozenges (each containing five grains of sulphur) are convenient. It is also contained in the compound liquorice powder, combined with senna.

So-called "dinner pills" used to be very largely used, and still are by many. They are taken before the evening meal, and hence the name. A favourite one with Lauder Brunton contained two grains each of compound colocynth and compound rhubarb pill, with one grain of extract of hyoscyamus.

¹*Trans. Assoc. of Amer. Physicians*, 1922, p. 430.

I have found that these quantities may usually be halved. Such a pill can be taken regularly for many years without the effect lessening. Brunton mentions one man who had never missed taking it once in forty years!

Many synthetic anthracene bodies have in recent years been tried as substitutes for natural purgatives, but most of them have been disappointing. The one that has been most successful is Phenolphthalein and it is a good deal used. It produces semi-solid motions in five or six hours. An average dose for an adult is five grains and for children one or two grains, in lozenge form, is often convenient.

When the motions are small and hard, Liquid Paraffin is very useful. It is not absorbed at all and acts as a lubricant and softener of the faeces. It also probably lessens the absorption of water from the bowel, which in these cases, as mentioned below, is excessive. The ordinary dose is a tablespoonful before each meal, and this amount can be gradually reduced. It has one objectionable feature, as some patients complain that it causes an oily leakage from the bowel. There are many different types of liquid paraffin on the market, and one should be chosen that conforms to the tests of the British Pharmacopoeia: also one with a high viscosity, as such mixes better with the faeces and is less apt to cause leakage. Another substance that was used a few years ago very much in this class of case is Agar Agar. This is Japanese isinglass, obtained from seaweed, and when taken in powdered form it swells up and thus increases the bulk of the stools. None of it is absorbed. It can be conveniently given mixed in porridge, and the average dose is one ounce once daily. Or it can be used thrice daily in smaller amounts. It can scarcely be called a drug, and sometimes is useful where there is any objection to drugging.

Where the trouble is chiefly dyschezia, i.e., the faeces arrive normally at the pelvic colon or even the rectum, and yet the tension here is not sufficient to produce the desire for defecation, Enemata are often of value. Plain warm or cold water, or warm soap and water, are generally used here, and just sufficient should be employed to set up the reflex act of defecation. There is no advantage in so-called high enemata.

It seems to be impossible to pass a soft rubber tube higher than four inches and if more is attempted the tube merely coils in the bowel.¹ Two inches insertion is quite sufficient and a pint and a half of fluid under 15 inches of pressure easily reaches the caecum, regardless of the posture of the patient. Glycerine injections or suppositories act by reflexly stimulating bowel contraction, but are apt to irritate if constantly employed. In children, one of the best remedies is the old-fashioned home-made soap suppository.

Olive oil injections are useful in cases where the faeces are very hard. The oil lessens the absorption of water from the bowel and also mechanically softens the masses. Sometimes even this is not sufficient to do this and then the scybala must be mechanically broken down, best with the tip of the finger.

In cases of want of tone in the bowel, strychnine is of use and it is very commonly combined with various laxative remedies. It is not directly purgative, but, by increasing the tone of the muscular coat, permits of the more easy production of the tension necessary.

Spasmodic constipation sometimes occurs. It may be the result of a fissure or other painful local lesion, or may occur from much purging, or again as a purely nervous phenomenon. These patients are made worse by purgatives, which merely produce severe griping, without result. Here belladonna is probably the best drug, owing to its antispasmodic action. One has even seen opium bring about a free movement of the bowels in such a case, set up by over-purging. Benzyl benzoate should act well here.

No mention has been made of the most common purgatives, viz., castor oil and calomel, nor yet of the stronger ones, such as croton oil, elaterium and jalap, as these are rather adapted for occasional than for habitual constipation. Nor has any mention seemed necessary of operative treatment for chronic constipation, although, in a few rare cases, where the condition is a complication of some organic condition, this may be required.

The subject of the treatment of chronic constipation is a

¹Hurst. *Lancet*, July 21st, 1923, page 134.

very large one, and, if fully discussed, would occupy too much space here, but the outline above given will perhaps meet most cases.

APPENDICITIS.

Until about thirty years ago the treatment of appendicitis, or rather typhlitis or perityphlitis as it was called, was entirely medical, no operation being even considered except for the opening of an evident abscess. But since about the year 1886, when Fitz localized the almost constant source of non-puerperal acute peritonitis in inflammation of the vermiform appendix, the removal of this organ has become extremely common. Some have urged that this should be done in every case at any stage. To such extremists there is no such thing as the medical treatment of appendicitis, inflammation there, always and at any stage, requiring the use of the knife.

It will now be admitted by most practitioners that appendicitis is largely a surgical affection, although this by no means implies that operation is always necessary. How common the disease is and how generally it is recovered from is shown by the fact that nearly forty per cent. of all bodies examined *post mortem* show evidence of the disease. Many of these probably had practically no symptoms during life and a large number still were so slightly ill that they never consulted their doctor, much less were seen by a surgeon. The surgeon tends to see the worst cases and his judgment must be influenced accordingly.

It is an interesting point that according to the English Registrar-General's Returns the deaths from appendicitis have been increasing since 1905. The deaths from peritonitis (non-puerperal) have decreased but not in sufficient amount to explain the rise in deaths from appendicitis. It is evident that either the disease is on the increase (which is unlikely) or the modern treatment is not so satisfactory as might be thought. James Berry, in his Presidential Address before the Surgical Section of the Royal Society of Medicine, recently¹ went so far as to say, "If we all were to go back to the old

¹*Lancet*, Nov. 11th, 1922, p. 1016.

treatment of appendicitis that was in vogue 40 years ago there would be a lesser mortality from appendicitis than at the present time." By this he could not have meant to condemn operation but only to urge the need of the proper selection of cases for this and especially the proper time for it. It may be added that in Ontario the deaths from combined appendicitis and peritonitis (non-puerperal) per 100,000 have fallen during the above period as follows:—

1901-5	30.5
1906-10	26.0
1911-15	26.4
1916-20	16.1

Thus the death rate from these causes has practically been cut in two here during the last twenty years.

From a therapeutic point of view appendicitis may perhaps be considered in several stages:

I. Early stage, up to twenty-four to thirty-six hours from the onset.

II. From then on to the end of the attack, whatever that be.

III. Relapsing appendicitis, in which exacerbations occur without the symptoms entirely disappearing between the relapses.

IV. Recurrent cases, in which acute attacks recur, with intervals of apparent health.

V. Chronic appendicitis, where the patient is never well, but suffers from vague pains about the right abdomen, gastric disturbances and more or less ill-health.

I. As soon as an individual has developed any symptoms of acute appendicitis, he should be kept absolutely quiet in bed: all food by the mouth must be stopped, and even water prohibited or only given in sips. If vomiting or distention be present lavage of the stomach is useful. The thirst may be lessened by small enemata of normal saline, frequently repeated. Some writers recommend purging here, but the majority, with whom the writer is in entire accord, absolutely forbid such, rest of the bowel and not activity being what is most desired. Experimental work has shown that increased peristalsis will distribute material throughout the peritoneal cavity. Thus A. J. Ochsner wrote "My former assistant, Dr. J.

L. Yates, has proven conclusively by a large number of experiments upon animals that infectious material is rapidly diffused by the administration of food or cathartics, because of the establishment of peristalsis. Injecting lamp black into the abdominal cavity, he found that this remained in a circumscribed location as long as the intestines remain at rest: but upon the administration of cathartics, it is rapidly diffused over the entire peritoneal cavity."

Locally, heat in the form of fomentations or mustard tends to ease the pain. Ice acts in much the same way and is preferred by many. Heat is generally preferred by children.

In the many cases where the diagnosis is for hours in doubt some such treatment as this can do no harm and should be carried out in all cases where any suspicion of the disease arises.

The patient should be seen frequently and many will within twenty-four hours be easier and will then recover. But in many instances the symptoms will point to a progressive lesion and then immediate operation is indicated. From a practical point of view the advisability of operation depends largely upon whether or not skilled surgery is available, and I entirely agree with Howard Kelly when he wrote that "the general practitioner, who does not often do surgical operations, would do better not to operate when a satisfactory surgeon cannot be found, unless there is a well-defined mass in the right iliac fossa with heat and tenderness—evidence of abscess formation."

When, then, in this early stage *skilled* surgery is unavailable (and I would venture to repeat this qualification of surgery once more) the practitioner will do well to give opium freely, which drug not only eases the patient's suffering, but, by lessening peristalsis and giving rest, tends to limit the inflammation and keep it localised.

Thus, one may consider the treatment of early appendicitis under two headings: (a) where a skilled surgeon is available, and (b) where he is not.

In both cases the patient should be kept absolutely quiet and given no food by the mouth; but in the former one we should defer to the general surgical opinion and abstain from

the use of opium until the treatment has been decided upon in conference with the surgeon, the fear always being that it will mask the symptoms.

It is hard to say in what percentage of early cases operation should be resorted to. In the writer's opinion it should be done in all well-marked cases which are hour by hour manifestly getting worse; and also without any waiting, in those rare fulminating cases where the patient is evidently very ill from the first. The temperature, pulse-rate and leucocyte count will help one to estimate the severity of the condition, but must not be relied upon too much, as they are all open to fallacy.

(b) Where, however, an early case comes under our care far removed from skilled surgery, then, besides keeping him quiet and starving him, and if necessary using gastric lavage, opium should be freely given, sufficient to keep the patient comfortable. Nothing else checks peristalsis so efficiently and hence tends to limit the infection. The pure drug, given by the mouth is usually the best form of administration, as it thus controls peristalsis better than when morphia is given hypodermically. If the stomach be very irritable opium may be given by the bowel.

The hurrying of these acute cases long distances by rail or road cannot be too strongly condemned.

II. When a case of appendicitis is first seen only after say two days and the infection may have spread beyond the appendix, which may be gangrenous and perforating, the question of operation is much more doubtful, and, according to some surgeons, is seldom now indicated. It was well said by Richardson that it is now "too late for an early, and too early for a late, operation." A. J. Ochsner, who has so often urged the dangers of operation at this stage, wrote as follows:—"In cases of acute appendicitis, either perforative or gangrenous, which have received some food or cathartics after the beginning of the attack and which reach the surgeon too late for a safe early operation, and are suffering from beginning diffuse peritonitis, gastric lavage, absolute abstinence from food and cathartics by the mouth, with the slow instillation of normal salt solution by rectum, is indicated. This will re-

sult in the increase of resistance against infection to such an extent that 97% of these cases of perforative or gangrenous appendicitis can later be operated upon with safety." And again, "Feeding should be entirely by enemata, preferably consisting of one ounce of commercial liquid food dissolved in three ounces of normal saline solution, given slowly every 3 or 4 hours through a small rubber tube introduced into the rectum not more than three inches. From 10 to 30 drops of deodorized tincture of opium should be added to each rectal feeding until there is no longer any pain." This was written ten years ago, but Dr. Ochsner writes now that it still represents his views and practice, and adds, "if this is not sufficient I give quarter grains of morphia, and 1/100 gr. of atropin hypodermically as often as it is necessary to stop the pain. In most cases, however, the pain does not reappear after the stomach has been carefully washed out."

The dread of waiting at this stage is always of general peritonitis, but such a danger is small if the patient be starved, the stomach washed out, etc., while the mortality of operating now is high, even in the most skilled hands.

The abstinence of food by the mouth should continue for at least three days after the acuteness has subsided. Later, operation will be required in all these bad cases, but can then be much more safely done.

Statistics are notably unreliable as they depend upon so many factors, but when Ochsner tells us that, in cases of "acute perforative or gangrenous appendicitis, with peritonitis and abscess, admitted to hospital after the third day and treated by the above method and only operated upon when they have reached a quiescent period," he has "a mortality of under 2 per cent," it should make us pause and ask if immediate operative results are likely to be as good.

James Berry wonders "whether it is sufficiently realized that most of these cases (i.e. ones not seen until late in the attack) would not die if not operated upon, and that a few days delay often puts the patient into a more favourable condition for operation if this should prove necessary."¹

The question of operation is largely dependent upon the

¹*Lancet*, Nov. 22nd, 1922, p. 1015.

surgeon, who should always be conferred with in these cases, but the practitioner will have to share the responsibility and hence these remarks in a medical work.

III. Occasionally, cases of appendicitis are seen in which relapses occur without the patient being free from symptoms between these exacerbations. More or less tenderness is constant in the right iliac fossa, and the temperature tends to be occasionally a little above normal. Such cases have little chance of recovery without operation and the practitioner should not hesitate in urging it.

IV. When a patient has apparently completely recovered from an acute attack of appendicitis, he may never suffer from it again, but in a considerable percentage of instances the inflammation recurs.

Appendicectomy in the quiescent period is an operation attended by so little risk that it may be advised with little fear in every case after even one well-marked attack. If, however, the patient refuse to undergo it, he should be cautioned in regard to his diet, the regularity of the bowels and the avoidance of chills, as lapses in these directions are apt to precipitate a recurrence.

V. Chronic Appendicitis. Occasionally one meets with people who, after one or more attacks of acute appendicitis, are never well, but suffer from vague abdominal pains, gastric disturbance and general ill-health. There is frequently a hypochondriacal factor superadded. These patients are very hard to manage and frequently go the round of many practitioners and are treated under many diagnoses with unsatisfying results.

Much has been written upon this subject lately, and the influence of chronic appendicitis, with resulting adhesions, has possibly been over-emphasized, but in very many instances the removal of the appendix brings about a cure, and the possibility of the trouble being primarily here should always be borne in mind, and, if the condition resist the influence of a careful course of dietetic and medicinal treatment, operation should be advised.

It is not uncommon to see patients, who have had the appendix removed, suffer from symptoms very much like those

of the last class mentioned,—constipation, dragging and pain in the right iliac fossa and often attacks of temporary intestinal obstruction. They are subjects of peritoneal adhesions. Careful dieting and the use of mild laxatives, such as cascara, senna, aloes, or liquid paraffin, with careful attention to the general health and endeavours to get their minds off that part of their abdomen, will often do much good, but occasionally it may be necessary to again resort to operation with the object of relieving the adhesions.

INTESTINAL PARASITES.

The intestinal tract is frequently the home of parasites. If these are not numerous they may produce no symptoms and are only discovered when evidence of them appears in the stools. On the other hand, they can be the source of much ill-health, as in the case of tapeworm and of hookworm. Round worms and thread worms are less serious invaders, but may produce many troublesome symptoms.

Tapeworm.—There are three kinds of tapeworm that invade man, viz., *Taenia Solium* (the pork tapeworm), *Taenia Saginata* (the beef tapeworm), and *Dibothriocephalus Latus* (the fish tapeworm).

The diagnosis can only be made by an examination of the segments appearing in the stools, and then the species of worm may be determined and so the source of the infection decided, but the treatment of all three kinds is the same.

The patient should be thoroughly prepared for treatment by giving him a purgative, such as five grains each of blue pill and colocynth and hyoscyamus, followed by a saline next morning. No food should be given next day, and that night a saline purge, preferably sodium sulphate, is administered. Next morning, after this has acted, the special vermifuge chosen is given. These anthelmintics all act best when the intestine is as empty as possible and hence the necessity for the preliminary purging and starvation.

The one usually selected is Male Fern, and a drachm of the liquid extract should be given and repeated two hours later, and two hours after the second dose $\frac{1}{2}$ oz. of Epsom salts or a drachm of compound jalap powder is taken. The

male fern can be given in milk, mixed with sugar, in an emulsion, or contained in capsules. The stools should then be carefully searched for the head of the worm, as until this is found we are uncertain whether or not the treatment has been effectual. The search is best done by diluting the stools with warm water and then straining them through black muslin.

Pumpkin seeds are often used instead of male fern, and are particularly suitable in old and in weak patients. Two or three ozs. of them are well bruised and then macerated for 12 hours in water, and the entire quantity taken in one draught, and followed by a purge an hour later.

Pelletierine Tannate, a mixture of the tannates of the alkaloïds of the bark of the pomegranate, is now official. The dose is 5-10 grs., repeated every two hours until three doses have been taken, the last being followed by a dose of salts.

A number of other drugs have been used here, but the ones mentioned are those most commonly employed and, if fresh, are usually effectual.

The head of the worm is very small and may be missed, even when searched for very carefully. It is not wise to repeat any of these courses of treatment merely because the head has not been found. It will be soon enough to do this when segments begin to appear in the stools again.

Hookworm.—This parasite is the cause of an enormous amount of sickness in many countries, especially in the Southern States of America, in India and amongst the miners in parts of Europe. In Porto Rico 30 per cent. of all deaths are said to be due to it. The infection occurs chiefly through the skin, from whence the *larvae* eventually reach the upper part of the small intestine and there become attached to the mucous membrane, and then suck blood and also cause leakage of this into the bowel. Thus a profound anaemia is produced, and much ill-health and even death may result.

This parasite should always be suspected in all cases of unexplained anaemia in countries where it is prevalent. The lesions through which the *larvae* have entered the skin cause "ground itch," and occur chiefly between the toes and also on all the extremities. The finding of the *ova* in the stools is an easy matter, once the condition is suspected.

A great many drugs have been used for the relief of the condition, especially Thymol and to a less extent Beta-naphthol and Eucalyptus, but more recently the Oil of Chenopodium has been found to give the best results. Thus, the Rockefeller Board for the investigation of Hookworm Disease, after many careful tests, came to the conclusion that the oil of chenopodium shows an efficiency of 92%, as compared to 82% for thymol, 60% for beta-naphthol and 40% for eucalyptus. The method used was to give the patient a liquid diet and a cathartic dose of magnesium sulphate. Next morning no breakfast, but a cup of tea. At 7 a.m. one gram (15.4 mins.) of oil of chenopodium is given in capsule or on sugar, is repeated in an hour, and again in another hour; and two hours after the last dose (11 a.m.) a second dose of Epsom salts. The dead worms continue to be voided for several days. There have been some cases of poisoning from the use of the oil of chenopodium in large doses, and it is well not to repeat the above course for at least ten days. The dose should, of course, be proportionately smaller in the case of children.

The active constituent of the oil is ascaridole and is highly susceptible to decomposition and the products of this are toxic.¹ Hence it is very important to use only a good oil.

If it be decided to use thymol it should be preceded by a saline purge and then given in two doses at an hour interval, each of 30 grs. Two hours after the second dose another one of magnesium sulphate should be given. No food ought to be taken during the course of treatment. Several such courses at intervals of a week are usually required for the complete cure of the condition.

Round-Worms.—These are very common in children, but occasionally occur in adult life also. They may cause no symptoms at all or a good deal of ill-health, and reflex disturbance occasionally amounting even to fits. The parasites are easily got rid of. Santonin is the favourite and very effectual vermifuge here. It is well to give it each night for three nights, followed in the morning by a saline purge, such as sodium sulphate. For a child of five, one grain is an average dose on each occasion. If given in the day time yellow vision is apt

¹*Brit. Med. Journal*, Sep. 9th, 1922, p. 476.

to be produced and may be disconcerting. Santonin is never given in solution, as it would then be quickly absorbed and highly toxic, and as it is soluble in castor oil it is better to use salines than this for the necessary purging. Many physicians combine a small dose of calomel (e.g. $\frac{1}{4}$ gr.) with each dose of santonin to assist in the purgation.

Thread-Worms.—These parasites infect the lower bowel in children, and cause much irritation about the anus, and sometimes much restlessness and reflex disturbances of all kinds.

In treating the condition, the life-history of the parasite must be remembered. After the *ova* leave the female worm they partially develop in the faeces but the embryos remain encapsulated in the shell. Sooner or later they are passed from the anus and then, if conveyed to the mouth of this or any other individual, the embryos are liberated in the stomach and then pass into the small bowel, where they reach maturity and impregnation is effected. The male then dies and the impregnated female migrates to the caecum where she remains until her *ova* are matured. She then descends to the rectum where part of her *ova* are expelled and she passes on along with them in the faeces or escapes by wriggling out through the anus, causing much irritation in so doing.

It has been shown that the parasites may continue to arrive at maturity for six or seven weeks following a single infection. Consequently, treatment must extend over that period to be entirely effectual.

It is most important that the cycle from the anus to the mouth should be broken and so the patient must be prevented from scratching about the anus, and so infecting the fingers. This can be largely effected by insisting upon the patient wearing closed drawers, or at night a long night-shirt, the lower end of which is sewn so as to form a sleeping bag of the garment.

For the killing of the worms santonin is of some value, but the most important part of the therapy is the use of various injections into the bowel. Infusion of quassia made by soaking $\frac{1}{2}$ oz. of the finely rasped chips in a pint of distilled water, is as good as any, and better than the B. P. infusion, which is

only of 1-100 strength. Or we may use vinegar and water (1-40) or lime water. Each enema should not exceed 5 ozs. in a child and a pint in an adult. It is hopeless to try and reach the caecum, where most of the worms are, but we can so kill those that descend to the lower part of the bowel. The treatment should be repeated daily for a week and then less frequently for at least a month in order to completely effect a cure. It is often a good plan to change the solution used occasionally. Thus, one can commence with the quassia and after a couple of days change to the vinegar, and so on. It is useful also to give an occasional laxative during the course, as this hurries more of the parasites down to where they can be reached by the injections.

The irritation about the anus may be lessened by smearing the neighbourhood of it with weak mercurial ointment or the official carbolic acid ointment.

CHAPTER XXV.

DISEASES OF THE KIDNEYS.

DISEASES OF THE KIDNEYS.

NEPHRITIS. ALBUMINURIA. BACILLURIA, PYELITIS AND
PYELONEPHRITIS. RENAL CALCULUS.

ACUTE NEPHRITIS.

Acute nephritis may be due to infection, toxaemia, or a combination of the two.

All kinds of infections may bring it about, but scarlet fever is the one most commonly to blame here. A chill seems often to precipitate an attack, but how little effect it has on healthy individuals was well shown in the first year of the war, when, although our men were for days and weeks exposed to severe cold and wet in the trenches, very few cases of nephritis occurred, and yet, when the spring had come and the weather was fine, an epidemic of it appeared. The same thing was seen in the American Civil War, where the greatest number of cases occurred in the month of July. All the same, in people who already have some kidney weakness, chills will precipitate an acute attack, as is the experience of every practitioner.

The symptoms and signs of acute nephritis can be placed in two groups, viz., those of oedema, and those of uraemia.

The former are puffiness of the skin around the eyes, the ankles and elsewhere, cough and signs of oedema of the lungs, etc.; the latter are nausea and vomiting, headache, interference with the vision, twitchings and even fits.

The urine is usually scanty at first, loaded with albumen and casts, and often there is considerable blood present.

Diagnosis.—The recognition of well-marked cases of nephritis is easy, but slight cases may be missed, and, on the other hand, the mistake may be made of considering albuminuria and nephritis as identical. (*vide* albuminuria.)

An endeavour should be made to find the underlying cause,

as this may be removable, and only then will the condition clear up. Often the cause has already stopped by the time that we see the case, and then nothing but its effects remain to be treated. Such was seen in the cases of Trench Nephritis, which poured into our base hospitals after the first winter of the war. The cause, whatever it was, had ceased before the patients reached hospital, and in consequence nearly all of them soon completely recovered.

Environment.—Bed and warmth are essential in acute nephritis, and we should be very cautious in allowing the patient out of bed (especially in cold weather) as long as there is any albumen in the urine. Even after he has apparently quite recovered, chills must be avoided, and it is well for him to wear woollen clothing. Any error in diet (such as a drinking bout), excessive exercise, extreme fatigue, and especially any infection, may quickly cause a return of the condition, so that for months after an attack, which has apparently quite cleared up, the patient should be considered convalescent but not well. The older he is the less apt is he to completely recover.

Diet.—At first, little food is necessary, and this should be of a non-nitrogenous nature. Carbohydrates and fats put little strain on the kidney and hence, if the stomach will stand them, can be given, but often there is much nausea and then feeding may be difficult. Arrowroot, cooked in water, is often a useful dish early, and supplies a certain amount of nutrition. Next, milk or butter milk may be given and should become the chief source of nourishment. Probably it is as well to limit the chlorides, although doubt is cast upon this by the frequent success of the Fischer treatment where these are pushed. There is certainly a retention of chlorides, but who knows if this be not in some way a protective process.

Gradually, as the acuteness subsides, other things may be added, such as bread and butter, various cereals and puddings. Fruits are allowable from the first, if the stomach permit. Meats, fowl and eggs should be a late addition and only gradually returned to. The inflamed kidney eliminates the products of nitrogen metabolism only with difficulty.

Fluids, in the form of watery drinks, are useful, unless there be oedema, in which case they should be much restricted.

Specific Treatment.—Sometimes, as said, we can find and remove a source of infection, such as some local septic focus; or a toxæmia, as from alcohol, mercury or chlorate of potash.

There are no drugs which have a specific influence for good in acute nephritis, but in scarlet fever and probably in other acute infections it seems sometimes possible to avoid an impending attack, which is suspected from a raised blood-pressure and the presence of blood colouring-matter in the urine, by the prompt use of a saline cathartic.

Symptomatic Treatment.—In most cases, when the patient has been put to bed, carefully protected from chill, and on a suitable diet, most of what is necessary has been done. But the kidneys may be spared some work, and the system relieved of toxins which normally are excreted by them, if the activity of the bowels and the skin be increased. "It should be remembered that the body as a whole presents to us an organism which, in the process of time, has developed a high degree of specialism,—to this organ the elimination of water and CO_2 , to that organ the elimination of the nitrogen output, certain salts and water, and so forth; but that the specialism has not been completed, and that other tissues and organs in minor and minimal degrees carry on more or less the same function. Thus there is no doubt that the bowels and the skin (to mention these two only) overlap the kidneys functionally more or less, *even in health*; but that in disease it is almost certain that their powers of elimination rise in proportion to the renal insufficiency, and to an extent which may convert them into adjunct or compensatory organs of appreciable value."¹ So when the kidneys are inefficient, we make use of the other sources of elimination. Thus it is good practice to give a sufficient saline to keep the bowels on the loose side, and if the symptoms be urgent more drastic purgatives may be required.

Sweating should, for the same reason, be encouraged by diaphoretics, or by heat in the form of hot packs, or hot-air baths.

Hot Pack.—The bed is covered with a rubber sheet, and over that a blanket. A large heavy blanket is then wrung out of very hot water and wrapped round the naked patient as he

¹Harrington Sainsbury. *Lancet*, 1920, II, 99.

lies on the bed. Several hot bottles are placed about him, and all covered with a dry blanket and the rest of the rubber sheet. An ice-bag should be placed on the patient's head. Usually sweating soon takes place, but if it be delayed it may be helped by a glass of cold water or of the Imperial drink. Usually the patient is kept in the pack for one hour, but should be taken out sooner if his temperature rises above 101° Fahr. On removal he is rubbed dry and put into dry, warm clothing.

The pack may be repeated daily, or even every eight hours in bad cases, or hot air can be used.

A hot air bath may be given in various way. A Turkish bath is a very efficient form, but not available in these acute cases. A simple method is to have a small alcohol lamp at one side of the bed, over which is placed an inverted metal funnel, with a pipe leading from it to under the bed clothes. In hospitals the heat can be efficiently applied by a series of incandescent electric-bulbs which are arranged in an arched frame that goes over the patient, leaving his head out. A temperature of 120° Fahr. usually produces sufficient sweating. Where these methods are not practicable, several bricks, heated in a stove and then wrapped in cloths and placed in the bed, often are wonderfully efficient.

Occasionally in uraemia the hyperdermic use of pilocarpine is necessary. An average dose of the nitrate is $\frac{1}{8}$ gr. for an adult and half this amount for a child of five years, and will usually produce much sweating.

If oedema be a feature of the case the purging and diaphoresis should be more thorough. As regards the former, one of the most efficient preparations is the compound jalap powder, which contains jalap, acid tartrate of potash and ginger, and may be given every night in doses of thirty to fifty grains. Mercurial purges are usually not advisable, as mercury tends to irritate the renal epithelium, but an occasional dose will do no harm. It is well to limit the fluid-intake here, and probably also to decrease the salt-intake, although the directly opposite course is adopted by Fischer, and he has many upholders.

In acute nephritis the fluid effusion is seldom sufficient to

make its mechanical removal necessary, but sometimes this is the case.

If toxæmia occurs, as evidenced by nausea and vomiting, dyspnoea, severe headache, dimmed vision, and twitchings or even fits, with probably (although not necessarily) a high blood-pressure, the purging and external heat should be pushed, and often a venesection will be required.

In fits, bromides, chloral and even chloroform are valuable, and sometimes spinal puncture will relieve them.

When the secretion of urine is scanty, dry-cupping over the kidneys is frequently helpful, and in bad cases, wet-cupping may be used.

The value of diuretics in the acute stage is very doubtful, but the citrate of potash or the acid tartrate of potash (as in the Imperial drink) will do no harm and may increase the urinary flow. The intravenous use of a 10-20 per cent. solution of glucose sometimes acts as a good diuretic in cases of anuria—200-300 c.c. may be given at a time.

The albuminuria is uninfluenced by any medicinal treatment as far as one can judge, although astringents of all kinds have been used here.

If vomiting be severe, gastric lavage is often helpful, or one may use a bismuth mixture.

Anaemia is a prominent feature in nephritis, and as soon as the acute stage is over and the stomach will stand it, iron should be given. One of the favourite forms of this here is Basham's mixture, which is made by combining the perchloride of iron with *liquor ammonii acetatis*.

During convalescence and as long as there are any symptoms and albuminuria the patient must be protected from chills and be kept on a rather low protein diet, but otherwise fed up, and, by gradually increasing exercises, got back to his normal state. It was frequently found in military work that systematic physical exercises were very helpful at this stage.

In most instances the recovery will be complete, but in a certain number the condition will persist and eventually drift into the state of chronic nephritis.

In the cases that do not soon clear up functional tests for determining the extent of renal impairment are valuable.

Alkalies have been shown to be of service in restoring the normal acid-base relationship where acidosis occurs.

CHRONIC NEPHRITIS.

Chronic inflammation of the kidneys may result from an acute attack, or may come on insidiously as an effect of infection or toxæmia, or as part of a general arterio-sclerotic process.

Often the term nephritis, which implies inflammation, is incorrect, as all that remains is a scarred and impaired renal tissue, the result of inflammation now gone. There is no more inflammation here than there is in most cases of so-called chronic endocarditis.

The symptoms of chronic renal damage may be slight and unnoticed or they may be very serious and progressive. They belong, as in acute cases, to two groups: (1) oedemic and (2) uræmic.

From the symptoms it is usually impossible to name exactly the pathological condition present, although oedema commonly suggests parenchymatous and uræmia fibroid changes. No attempt will be made here to distinguish between the very badly defined "types" of the condition.

Diagnosis.—Oedema or symptoms of uræmia may be present and, or, the examination of the urine may show some abnormality either in quantity or quality. The functional renal tests, such as the phenolsulphonephthalein test; the concentration test, and the measurement of the day and night urine, are here of great value, and the examination of the blood-serum for the non-protein nitrogen often throws much light on doubtful cases of atypical uræmia. The presence of indican and skatol in the urine is an indication of intestinal toxæmia, and suggests that the diet should be revised.

There is some relationship between the total output of urine and the amount of oedema, but it is a very uncertain one; in some cases oedema may be great, and yet the urine not much diminished, while in others the urine may be almost suppressed and yet oedema may not be evident. Oedema is a toxic phenomenon rather than a mere mechanical retention of water.

The cause of chronic nephritis may often be found, such as some local and low grade infection, an intestinal toxæmia, metallic poison, e.g., lead, etc., and in many cases is removable and then the existing nephritis may clear up or at least become quiescent.

Environment.—Chronic nephritics need not be kept in bed unless the symptoms demand it. There must be no exposure to cold and, if possible, it is well for them to winter in a genial climate. The clothing should be of wool.

These patients are very liable to have acute attacks. In a series of 200 cases of trench nephritis studied in France we had two fatalities and both of these proved at *post mortem* to have signs of old nephritis in addition to the acute condition. All sources of infection must be avoided. It would never do for a chronic nephritic to be knowingly exposed to the infections of scarlet fever or diphtheria.

Although these patients need not be in bed they should have much rest. A couple of hours' rest after the midday meal is often valuable, and the patient may be able to go about his ordinary work at other times.

Diet.—In chronic nephritis the diet should largely consist of carbohydrates and fat, and a lacto-vegetarian one is the best, but, unless any symptoms of toxæmia be present, it is not necessary to forbid meats, fowl and fish altogether. These must, however, be used in great moderation and not more of them allowed than are necessary to supply 50-80 grams of protein in the day. It is an easy matter to work out the equivalents of these from the tables found in any reference volume. Alcohol should be forbidden, and spices and all highly-seasoned dishes avoided.

Unless oedema be a feature it is better for the patient to take water freely, as it dilutes the urine and may act as a solvent, and also washes out the renal tubules.

If oedema be troublesome and does not yield to simple treatment it may be well to put the patient to bed and on a strict Karell diet. (Page 210.)

Specific Treatment.—Any source of chronic infection should be searched for and treated. The tonsils and teeth should be specially suspected here, but the focus may be any-

where, e.g., in the prostate gland. Some cases are syphilitic, and will only yield to a course of salvarsan, which here must be given with great caution and used only in small and gradually increasing doses, the urine being constantly watched for any signs of renal irritation.

Symptomatic Treatment.—The bowels should be kept gently opened with salines, and occasionally, where oedema or toxæmia are very evident, the purgation must be pushed.

No medicines are needed, as a rule, in a routine way, beyond the laxatives, unless for special symptoms that may arise.

The mere fact that the blood-pressure is high does not suggest the use of vaso-dilators. The patient often feels better when the pressure is raised;—it may be compensatory in his case. At the same time, the proteins should be kept low as part of the case may be toxic, and, as already mentioned, such toxins chiefly arise as products of abnormal protein digestion. The chief pressor toxin here appears to be a monamine corresponding to the proprietary preparation called tyramine.

Occasionally, however, the raised blood-pressure itself causes distress, and cerebral hæmorrhage or acute dilatation of the heart may threaten, and then it may be necessary to temporarily lower it by drugs (such as sodium nitrite, 1-5 grains) or by an occasional hot-pack. Sometimes even a venesection may be required. Anaemia is often a prominent feature in chronic nephritis and, although largely toxic in nature, may be lessened to a certain extent by the use of iron.

If oedema be considerable the purging should be more thorough: magnesium sulphate may be given by Hay's method, in which two ounces of the salt in two ounces of water is taken after a twelve to eighteen hour fast. Many pints of fluid may be evacuated in this way, and the method is specially valuable in those cases where acute oedema of the lungs or brain suddenly supervene. The fluid intake should be restricted and the salt one also, unless, indeed, the Fischer treatment be tried. Fischer has found by experiment that acidosis will cause oedema and albuminuria, and that these may be relieved by alkalies. He argues that in chronic nephritis we have acidosis and that this may similarly be overcome with alkalies. Fur-

ther, he has shown that by giving sodium chloride freely less alkali is needed to overcome the acidosis and oedema. He gives a hypertonic solution (sodium chloride 14 grams. sodium carbonate 10 grams. and water 1000 c.c.) by the rectal drop-method, using 500 c.c. of this twice daily, although double this amount may be given at once if there be symptoms of uraemia. It may even be given intravenously in urgent cases. In addition he gives alkalies and sodium chloride freely by the mouth. The liquid-intake is not limited, but all liquids should be isotonic or hypertonic so as not to overcome the effects of the solution given above. The diet consists of soft foods, heavily salted.

Such a treatment seems directly contrary to what is usually believed to be correct, in that it contains so much sodium chloride and water, but the results are said to be good. It would suggest that the retention of chlorides in nephritis is a compensatory process and hence need not be lightly interfered with.

Diuretics are sometimes of value in these oedematous nephritics, and the ones least apt to irritate the renal epithelium are the salines, especially bitartrate of potash (cream of tartar) and citrate of potash; the ordinary dose of each of which is 15-30 grs. t.i.d. Caffeine or diuretin (*theobrominae et sodii salycylas*) sometimes act well here. Plain theobromine in five grain doses is often valuable, or theocin in similar doses, given every four hours for a short time. If the oedema be considerable it may require removal by mechanical means, such as by Southey's tubes or by multiple incisions. When an effusion interferes with any organ, such as the heart or lungs, it should be promptly removed.

The heart often tends to fail in chronic nephritis, and this failure may increase the dropsy. Digitalis may then be required, as described under the heading of heart affections.

Where toxæmia threatens (with headache, nausea and vomiting, etc.) the patient should be in bed and be given hot-air baths or hot-packs. Drastic purgation (as with compound jalap powder, $\frac{1}{2}$ -1 drachm, or croton oil, 1-3 mins.) is required, and pilocarpine nitrate may be used in doses of $\frac{1}{10}$ - $\frac{1}{4}$ gr. by the mouth or hyperdermically in half these amounts.

There is always some danger of this drug producing pulmonary oedema, but this is less likely to occur here than in oedematous cases. It is a very powerful diaphoretic, and has no definite action on the kidney. If the toxaemia be more marked, venesection is the most powerful method we have of lessening it. Some follow this by an intravenous saline injection, but in cases showing much oedema this should be omitted or replaced with a 10 per cent. glucose one.

Insomnia is a frequent symptom in chronic nephritis, being often associated with nocturnal dyspnoea. Besides all the measures already mentioned for the relief of toxaemia, alkalies are useful here. Often a teaspoonful of bicarbonate of soda taken in hot water at bed-time gives relief; or we may require to use hypnotics, such as bromides or trional. If there be much excitement, paraldehyde is valuable and may be given in doses of one or two drachms at bed-time. A hyperdermic injection of hyoscine will often quiet such a patient and an average dose is 1/150 gr. of the hydrobromide. Many fear the use of morphine here, but occasionally it is indispensable.

Some years ago Edebohls advocated the decapsulating of the kidneys in cases that were getting worse in spite of all treatment. The idea was to relieve tension in the kidney and also to establish new vascular connections there. Many cases were for a time much benefitted, but their subsequent history was not so good, and it was found that a new, firm, fibrous capsule soon formed. The operation is seldom done now for nephritis, although Sir Thomas Horder¹ has recorded four cases of sub-acute nephritis, with massive albuminuria and much oedema, two of which appeared to be quite and the other two much, relieved by the procedure. I have seen several cases much improved by it.

ALBUMINURIA.

The appearance of albumen in the urine may mean "little or nothing or much." Under certain circumstances, such as after hard exercise, a cold bath, a heavy protein meal, etc., it will occur in a large proportion of people, and is of no significance. Young persons are apt to show it after standing, and

¹*Brit. Medical Journal*, Nov. 13th, 1920.

yet it is absent while they are horizontal (orthostatic albuminuria). There has been much discussion as to whether albuminuria can occur physiologically, or whether it always means some change in the renal epithelium or in the glomeruli. The investigations of H. MacLean¹ bear on this point. He examined the urine of thousands of A1 men, just arrived in France for active duty, and found albumen present in five per cent., and in considerable quantity in two per cent., and 1.87 per cent. showed some casts. It was thought that perhaps the hard training through which the men had just come, preparatory to crossing the Channel, might account for the condition, so he next examined a large number of recently joined troops, all of whom had been passed as sound, and found that the same percentages occurred here also. Altogether 60,000 recruits and trained men were examined.

Lt.-Colonel R. J. Gardiner, Medical Officer of the Royal Military College, writes, in reply to a letter of enquiry, as follows: "Our experience seems to point to the fact that our young men under heavy physical strain may have albuminuria which readily disappears when they are put to bed to rest for a few days, and so far as we have been able to determine does not mean any serious physical condition."

Evidently albumen, and even a few casts, are of commoner occurrence in young adults than was believed, and by themselves mean nothing. Albumen very frequently appears in the urine in pregnancy, and also in fevers and various toxæmias. Here it probably points to some passing irritation of the renal epithelium, and will disappear, although it is well to regulate the diet in the meantime so that the strain on the kidney may be as light as possible.

Diagnosis.—When albuminuria is discovered, it is important to find the cause, and to make sure that it is not due to some contamination or caused by inflammation in the lower urinary tract. When true albuminuria occurs it may be a symptom of nephritis; of renal irritation, as in fevers or in errors of diet; or circulatory, as in the orthostatic type, or from exercise or chilling of the surface of the body, or, more seriously, from actual disease of the heart. Sometimes an unexpected

¹*Journal of the Royal Army Med. Corps*, December, 1918.

source of local infection (as in the tonsils) may be the cause, and the albumen will clear up when this is removed. As above stated, albuminuria is specially apt to be of slight and passing significance in adolescence.

Environment.—Although albumen may mean nothing, at the same time it is at least a temporary abnormality and should be watched. Insurance companies wisely refuse applicants showing the condition. When it clears up they may be accepted, but in the meantime there is an element of uncertainty about the outcome.

If more than a trace of albumen is produced by any of the causes mentioned above, such as hard exercise, cold bathing, etc., it is well to omit that cause from the patient's daily life. All the same, MacLean, on tracing his albuminuric soldiers, did not find that they tended to get worse or develop nephritis, even in the strenuous life of the front line.

No drugs have any direct effect in reducing albuminuria, although many have been tried, chiefly those of the astringent class.

BACILLURIA, PYELITIS AND PYELONEPHRITIS.

Infections of the urinary tract are very common and may follow local damage, as from renal calculi, or may occur without this. The infection is sometimes an ascending one from infection of the bladder, but is more frequently haematogenous and then comes from some focus of infection in the teeth, tonsils, or elsewhere.

In pure bacilluria there may be no local symptoms, but the condition will produce fever and ill-health, and an examination of the urine may show this to be cloudy and laden with bacteria.

Cases of pyelitis occurring in the course of acute fevers usually soon clear up.

Diagnosis.—A careful examination of the urine is all-important in continued fevers of obscure origin and often will clear up a doubtful case by revealing a bacilluria. This is most commonly the case in children. In pure bacilluria the urine may be found to be laden with bacteria, usually the colon bacillus, but with few other changes, while in pyelitis there

will also be pus present. In the latter case it is very important to find by a cystoscopic examination if one or both kidneys are involved. Although the colon bacillus is the commonest cause of infection here, almost any organism may occur and the tubercle bacillus is only too common.

Cases of persistent pyelitis and of pyelonephritis are largely surgical, but some of them and most of the ones of pure bacilluria are amenable to medical treatment.

Environment.—The patient should be in bed and kept warm. If there be any pain, hot applications over the region of the kidneys will give much relief.

Diet.—It is well to keep the proteins low. Milk is our standby here, although occasionally in stubborn cases its complete stoppage may do good as Sir Thomas Horder¹ points out. Large quantities of bland fluids, such as barley or oatmeal water and the like, are useful in diluting the urine and thus washing out the urinary tract.

Specific Treatment.—Every possible source of local infection should be systematically searched for and if possible removed. After this is done a urinary infection may quickly subside. Autogenous vaccines are of some value and should always be borne in mind, but in most of the slighter cases are not required.

The colon bacillus best thrives in an acid medium, and, generally, by rendering the urine alkaline we can get rid of a bacilluria due to this organism. This can be best done by the administration of 20 grs. of acetate of potash every four hours and then thrice daily. Citrates and tartrates act in the same way and may be used in the same doses, but sometimes any of them must be given in much larger amounts before the urine becomes alkaline.

The other way of attack is by the use of antiseptics and here urotropine (hexamethylenetetramine) is the best. An average dose for an adult is 10 grs. t.i.d. Theoretically, urotropine only acts in an acid medium and hence the urine if not already acid should be rendered so, and this can be done by giving the acid sodium phosphate in 20 gr. doses t. i. d. Urotropine sometimes causes some urinary irritation which

¹*Lancet*, Nov. 12th, 1921, page 990.

can be lessened or avoided if it be combined with ammonium benzoate, and this drug, in 5-15 gr. doses, also tends to make the urine acid which is an advantage here.

In prolonged cases it is sometimes advisable to alternate the treatments. Thus, if the urine be acid the urotropine can be given for, say, a week; then it is stopped and the potassium acetate is pushed until the urine is decidedly alkaline.

Some bacteria, for example, *staphylococci*, thrive best in an alkaline medium, so if the infection be due to them the urotropine with acids is the best medication.

If the urine be loaded with pus and this is shown by the cystoscope to be coming from only one kidney, then the question of incision and drainage or even the removal of the offending kidney will come up. The same remark applies to renal tuberculosis. Even when the bladder is here also infected it may clear up when a tuberculous kidney has been removed and the source of the infection thus eliminated.

RENAL CALCULUS.

Concretions may form in the substance of the kidney (so-called "infarcts") or in the pelvis. The latter may be numerous and small and freely pass down the ureter into the bladder and so out, forming urinary "gravel." The passage of these minute fragments may be painless or cause more or less distress. Or the stones may be so large that they only pass with difficulty and then cause the excruciating pain of Renal Colic. Or, in the last place, they may be of such a size that they cannot enter the ureter at all, and then may cause little or no distress unless their mechanical presence sets up a pyelitis. I recall the case of a soldier who was admitted with severe haematuria following a kick received in the abdomen at football. He stated that he had had a similar kick eight years before, and had then also passed much blood, but had had no distress since. In a few days the urine was normal, and the patient felt quite well, but was X-rayed as a matter of routine, and an enormous calculus was seen occupying the renal pelvis. This was removed by operation. The interesting point was that, although this stone had evidently been there for years, it had caused

absolutely no symptoms except on the two occasions when the abdomen had been kicked. Then, no doubt, it acted as an anvil.

Diagnosis.—The presence of a stone can often be strongly suspected from the symptoms, especially when attacks of colic occur, but the X-ray should always be employed to confirm the diagnosis, and it will thus often clear up the cause of many an obscure pain in the back.

Environment.—Nothing special need be said here.

Diet.—In all cases of stone it is wise for the patient to drink large quantities of water, well in the form of barley water. From the condition of the urine we can often make a shrewd guess of the chemical nature of the calculus. If this be the common uric acid or urate one, then alkaline drinks, such as the Imperial drink, and the various natural waters of an alkaline nature are indicated. The diet here should be low in proteins and of the kind described under the heading of chronic gout. Uric acid gravel and calculi are very common in young infants, and often give rise to great distress.

If it be suspected that the calculi consist of oxalates then probably there is dyspepsia present and a depressed nervous condition, which must be carefully looked into. Certain fruits and vegetables are specially apt to increase the oxalates in the urine and should be avoided. Such are rhubarb, strawberries, tomatoes and spinach. Large alkaline draughts are here again of value.

If the calculi are believed to be phosphatic, the probabilities are that the urine is too alkaline, and excess of vegetables and fruits should be curtailed and meat freely permitted. Alkaline drinks are contra-indicated but free diluents, such as the barley water, are again advisable.

Specific Treatment.—Short of operation, is there any treatment which will tend to get rid of the calculi? This is a much discussed question. Personally, I doubt if much can be done, but certain waters have a reputation in this way, and they may at least lessen the tendency to further concretion, and ease the accompanying catarrh. Waters of this kind are those of the Saratoga Springs in America and of Vichy and Ems in Europe. Sir William Roberts believed that large doses of citrate of potash ($1\frac{1}{2}$ -1 dr. in a tumbler of water every 3

hours) had a solvent effect in uric acid calculi. One can see that if a catarrh about the orifice of the ureter in the pelvis of the kidney be lessened (and the making of the urine alkaline may so act) a stone may pass into the ureter and then be hurried on and expelled when otherwise it would have remained in the pelvis. Thus, drugs like citrate of potash may be of value even in the absence of any solvent action.

Piperazine (diethylene-diamine) has a solvent effect upon uric acid *in vitro*, but in the doses in which it can be given (5-15 grs.) it is very doubtful if it has any such action in the body.

When the calculi are phosphatic, alkalies are contraindicated and the urine should be rendered and kept acid by the free use of the acid phosphate of soda in doses of perhaps 30 grs. every four hours.

The question of the removal of a renal calculus by operation is an important one. It does not follow that a stone should always be thus attacked just because it has been discovered by the X-ray. It may do no harm and produce no symptoms or any evidence of infection. But, when symptoms of pyelitis occur, or when there is much pain, or when frequent attacks of renal colic take place and the X-ray reveals the presence of calculi, then operation is indicated. This can be undertaken with a lighter heart if a cystoscopic examination shows that the condition of the other kidney is normal. If this be not the case or if stones are present on both sides then we should be very cautious about agreeing to operation unless the urgency be great.

Symptomatic Treatment.—There may be no symptoms requiring treatment. If pain (short of colic) be present, hot applications to the back will be of service, and also hot baths and especially Turkish baths. Massage will do harm, as many a patient finds when he employs this for what he believes is lumbago. If any symptoms of irritation of the urinary tract be present then the treatment discussed under the heading of Pyelitis may be employed.

RENAL COLIC.—This is the most urgent symptom of renal stone. The pain is due to muscular spasm in the ureter, and our treatment must be directed towards relieving this spasm

(which is holding the stone in its grip and so preventing its onward passage) and also to the easing of the pain in the meantime.

The patient often vomits, and it is a good plan to encourage this by copious draughts of warm water, as vomiting is always accompanied by general relaxation. Heat applied locally over the affected side in the form of fomentations or of poultices is useful, or the patient may get into a hot bath and stay there for some time. Morphia is usually necessary, and may be given with a free hand, always combined with atropine, which itself tends to relieve spasm. Benzyl benzoate has lately been extolled as an efficient spasm reliever and may be tried. An ordinary dose of it is 25 mins. of the 20 per cent. alcoholic solution, diluted with water, but as much as 60 mins. may be used in an emergency.

Occasionally the agony can only be relieved by a few whiffs of chloroform. Usually, after a few minutes to a few hours, the stone passes into the bladder and immediate relief occurs. In rare instances it does not so pass, and then the question of its surgical removal from the ureter must be considered.

By an examination of the calculi that have been passed the practitioner may learn the chemical nature of them and then must carry out treatment to prevent if possible the formation of further ones. Something may be done in this way by the regulation of the diet as already discussed and especially, probably, by the free drinking of water, medicated or pure. Ochsner calls attention to the value of rain water here.

Occasionally, in renal colic, complete anuria occurs. This may be due to plugging of one ureter and the nervous inhibition of the opposite kidney, or to the fact that this kidney has previously been destroyed by some condition and the patient has been depending upon the one that is now thrown out of action by the impacted stone. The case is very urgent and, unless the stone soon passes and the flow of urine is re-established, operation will be required, much more urgently, indeed, than would otherwise be the case.

CHAPTER XXVI.

DISEASES OF METABOLISM.

GOUT. OBESITY. DIABETES MELLITUS AND GLYCOSURIA.
SCURVY. RICKETS.

GOUT.

The essential nature of gout is not known, but the disease is characterized by arthritis due to the deposit of biurate of soda in and about the joints, and by various constitutional symptoms. Along with these there is an increase in the uric acid in the blood, but that this is not the essential cause of gout is shown by the fact that a similar increase occurs in leukaemia and chlorosis, and yet no gouty symptoms here appear.

It seems as if gout were a toxaemia, probably of hepatic, renal or intestinal origin, and that the uric acid deposits are merely incidental. The term "uric acid diathesis" would hence be a misnomer here.

Uric acid is formed from the nucleo-proteins of the tissues and of the food through the action of a specific enzyme. Birds and serpents are unable to oxydize the uric acid thus formed, and excrete it in large quantity. All mammals with the exception of man are able to oxydize uric acid freely through the action of an enzyme called *uricase*, and thus is formed the more soluble allantoin, which is then got rid of. In man this oxydizing process is poor and so he excretes uric acid in the urine, and any increase in the purin intake will be normally followed by an increase in the amount of the uric acid so got rid of.

Increase in the production of uric acid, or decrease in the oxidation or in the excretion, will tend to cause a rise in the uric acid content of the blood. This rise occurs in gout, and is greater during an attack than in the interval, but, as already said, this in itself will not cause gout, for it does not

do so in leukaemia and chlorosis. Something more is needed, and this may be the tendency to precipitation of the acid, as biurate of soda. During an acute attack the output of uric acid is usually increased, and at the same time that of phosphoric acid also greatly rises.

Although the chemical pathology of gout is thus so uncertain, clinically we know well the factors that tend to cause the condition, and so precipitate attacks. These are heredity, alcoholic drinks (especially fermented liquors and rich wines), food rich in purin bodies, nervous worry and want of exercise.

The first of these causes is probably the most important, and Roberts estimated that among the well-to-do classes in England, fully three quarters of the cases of gout showed a gouty heredity.

In gouty people there is much idiosyncrasy, and what will precipitate an attack in one will not do so in another. Most sufferers soon learn their special *bête noire*.

The symptoms of acute gout are so characteristic that no one can mistake them, but the irregular forms of the chronic disease are often very obscure and liable to be missed.

(a) ACUTE GOUT.

Diagnosis.—The acute arthritis is usually in the metatarsophalangeal joint of a great toe, but occasionally other joints may be attacked as well or alone. There is fever and often much depression. In some cases, the heart may be attacked, with more or less serious involvement of the myocardium.

Environment.—The patient should be in bed, or if restless, in a comfortable chair, with the affected limb raised.

Diet.—During an acute attack little is required, but the patient should drink freely of bland fluids, and milk and soda water make a good and nourishing diet now.

Specific Treatment.—Colchicum has in some quite obscure way a specific effect here, and nothing else will so quickly control the acute symptoms. It should be given as the *vinum colchici*, in doses of 10-30 mins. every four hours the first day, and then less frequently. Or the *tinctura colchici seminum* may be used in half these amounts. It is well to combine with

it citrate of potash, or citrate of lithium in 20 grain doses. The active principle of colchicum is *colchicine*, and this can be used in doses of 1/120-1/32 gr.

Colchicum is a nerve-depressant and should not be given for longer than is necessary. It has no effect upon the uric acid excretion and in medicinal doses no evident action upon the bowel, skin or kidneys. Colchicine has a very decided action upon the leucocytes in increasing the number of basophilic cells in the blood. Dixon suggests that its good effect in gout may possibly "be brought about by its action on the connective tissue cells and white blood corpuscles, or it may be by a nervous effect."

Some patients do not stand colchicum well, and in such the salicylates may be of some use.

Atophan (cinchophen or phenoquin) is of some value in acute gout, in doses of 5-10 grains every 4 hours, combined with alkalis. It increases the output of uric acid.

Symptomatic Treatment.—At the commencement of an attack a sufficient mercurial purge should be given, such as three to five grains each of the blue pill and the pill of colocynth and hyoscyamus, followed by a saline next morning.

The affected joint should be elevated and fomented with a hot solution of soda (1 in 40) or a saturated one of magnesium sulphate. Later it may be wrapped in cotton wool.

If the pain be very great a hyperdermic injection of morphia may at first be required.

An acute attack usually lasts for about a week, and then the symptoms gradually subside, and the patient may feel better than he has done for months, until, indeed, a new storm begins to gather. It appears as if there were a slowly accumulating toxæmia which culminates in a precipitation of biurate of soda, producing local inflammation but a relief of the general poisoning.

(b) CHRONIC GOUT.

In some gouty people acute attacks do not occur, but they suffer from chronic ill-health and in a way are to be pitied more than those who get their periodic storms, but are comparatively or even very well between them.

In both these classes the treatment is directed towards reducing the obscure toxaemia, and in raising the general health in every possible way. As already said, uric acid is not itself the cause of gout, but it is in some way associated with it so that treatment that lessens uric acid also tends to relieve the gouty symptoms.

Diagnosis.—There may be a typical history of previous acute attacks, but sometimes this is missing. The presence of *tophi* on the ear margins, the patient's heredity and habits, the condition of the urine and blood vessels, and often a raised blood pressure, all help to make the diagnosis evident.

Environment.—The ideal life for a gouty person is well hinted at in Pirckheimer's famous "Apology for gout" (1520), quoted by Osler. Podagra (representing gout) is made to say, "I take no pleasure in those hard, rough, rusticke, agresticke kind of people, who never are at rest, but always exercise their bodies with hard labours, are ever moyling and toyling, do seldom or never give themselves to pleasure, do endure hunger, which are content with a slender diet." To put the matter in other words, an active abstemious life is best for the gouty. If exercise cannot be taken, on account of stiff joints or for other reasons, gentle massage, hydropathy and radiant heat baths may partially take its place, and are largely developed at the different spas where these people tend to congregate, having found from experience how much they benefit from a sojourn there. A sedentary life is bad and where possible should be varied by the taking of as much exercise as can be got in the open air. Worry strongly predisposes to gout, and yet is often hard to avoid in the very man who suffers from the condition, as he is usually irritable and highly strung.

Gout is apt to occur in lead workers and a change of occupation should here be advised.

Diet.—Generally speaking, the diet should be a lacto-vegetarian one, with plenty of fluids, especially between meals. Many of these patients are large eaters, and it is the quantity, as much as the quality of their food that does harm.

Fats are freely permissible, but much sugar is bad and

easily tends to cause glycosuria here. Meat should be allowed only in great moderation and food rich in purins, such as sweet-breads, liver, kidney, brain, roe, etc., should be excluded. Fish can be taken in moderation. Milk, butter, eggs, cheese, white bread, most cereals, fruit, nuts and green vegetables, are nearly purin-free, and may be safely taken. Many advise the limitation of common salt in food, on the theory that it tends to make the uric acid crystallize out as the biurate of sodium. Alcohol is better avoided, although in those used to it and up in years a little whisky, or brandy, or still hock or moselle sometimes seems to do good.

Various mineral waters are much used in chronic gout. Probably the chief element in them is the water itself, but the salt content may have some solvent influence. The potassium or lithium in them are believed by many to be of value.

In cases of persistent chronic gout Guelpa's method of treatment has many advocates. It consists in starvation *plus* saline purging. The patient is given occasional starvations for three day periods and during them daily doses of an ounce of sodium sulphate. This occasional depletion and the removal of possible toxins from the bowel often clears up gouty manifestations better than anything else known.

Specific Treatment.—Colchicum is not much used in chronic gout or between acute attacks, and is better reserved for those paroxysms, although it is an ingredient of many of the "gout specifics" on the market, and is occasionally of some value here.

A host of drugs have been advocated as solvents of uric acid, largely on the ground that they so act *in vitro*. Such are, piperazin, atophan, urotropine and many others. The clinical evidence of their value is slender, as is also that in favour of the once vaunted lithium. The salicylates seem to be of some value, but probably the best of all is potassium iodide, in doses of 5-10 grains t.i.d. Guaiacum in doses of five grains t.i.d. sometimes is of use. Ammonium chloride is often used here, and a combination such as the following seems to help many of these cases.

R	Pot. Iodid.	
	Ammon. Chlorid.	āā 5ij.
	Pot. Acetat.	
	Ext. Glycyrrhiz. Liq.	āā 3ss.
	Aq. Chloroform.	ad 3vj.
	M.	

Sig.—A dessertspoonful in water, three times daily after meals.

Symptomatic Treatment.—The bowels should be kept gently open with daily salines, and probably a weekly mercurial is of benefit, especially in full-blooded individuals.

Any stiffness or induration may be treated by massage, but this must be very cautiously done, or it will work more harm than good. Painful, aching joints may be fomented with an alkaline lotion, or a liniment gently rubbed in. The "A. B. C." liniment, which consists of equal parts of the liniments of aconite, belladonna and chloroform, is a good one here. Counter-irritation is not as a rule advisable.

The chalky deposits should be left alone; they cannot be removed by any drug, and X-rays, radium emanations and electricity are all useless here.

The gouty individual is specially liable to all manner of ailments, such as dyspepsia, glycosuria, neuritis and neuralgia, eczema and cystitis, all of which may require special treatment, but this will succeed better when the underlying gouty condition is attended to as well.

OBESITY.

An excessive deposit of fat in the tissues may occur from errors in diet and lack of exercise, from abnormalities in the internal secretions, especially those of the thyroid and pituitary glands, and from hereditary influences. In certain families all the members tend to become stout as they get older. This hereditary tendency is difficult to check and its results can, at the best, only be partially controlled.

There are, of course, all degrees of fatness,—from that in which a healthy individual is only a little beyond the average

weight for his height, to that in which he is almost completely incapacitated from sheer bulk.

Statistics show that overweight constitutes a bodily impairment, especially after middle life, and insurance companies find that it considerably increases the probable mortality. This bears out the old couplet,

“Happy the leane, when age increases
The stout man quickly goes to pieces.”

Diagnosis.—In an individual case it will help much in the prognosis if we know to which of the above classes the patient belongs. The most hopeful cases are those of the first class in which the intake of fat-forming food has been excessive and the exercise insufficient (so called *exogenous obesity*.) Any alopecia, somnolence and dryness of the skin suggests thyroid insufficiency, while maldevelopment of the sexual organs, atypical hair distribution, and large breasts (in the male) point to hypopituitarism.

Environment.—It goes without saying that exercise is useful here, and it should be encouraged as much as possible, although never pushed to such excess as to render the patient breathless. Walking, especially in the pursuit of some game, such as golf, is particularly useful, and hill-climbing is a frequent way of losing weight pleasantly: it is an important part of the Oertel treatment. Swimming often helps considerably. There are numerous special systems of exercise which can be carried on in-doors, and they are all useful if the patient will only persevere in them, but this is the difficulty.

Where exercise, for some reason, cannot be freely taken massage is of value.

Diet.—The dieting of the obese is a very important subject, and has led to much difference of opinion; and various special systems of treatment have as their basis very varied quantities of the different ingredients of diet.

Generally speaking, it may be said that fats and carbohydrates should be reduced, and many would also lessen the quantities of fluid taken at meals, although the effect of this is very questionable except when there is also oedema. But the tendency to obesity is so great in some people that they will fatten upon a diet that will half-starve a normal person.

It is well to remember that fat may be produced from proteins.

Most of the "cures" for obesity provide a diet that is so manifestly low in calories that, although they produce a loss in weight they also cause much weakness from starvation and cannot be continued for long. Thus, in the Banting system the calories are only 1100 and in the Gutman one the same. The von Noorden dietary yields 1400 calories. These dietaries cannot here be discussed in detail and may be found in any reference hand-book. The Weir Mitchell system was simple and easily carried out, and often very satisfactory. It consists in merely giving a tumbler of milk containing an egg every three hours while awake, for three weeks at a time. In the Salisbury system the diet consisted of beefsteak and hot water. As modified by Towers Smith it is often very effectual and is usually well borne by patients. He gives during the first two weeks, for breakfast and luncheon, one pound of lean meat; for dinner one pound of grilled cod and one pound of lean rump steak, and at intervals during the twenty-four hours, one gallon of hot water, and the last thing at night half a glass of whisky. During the next three weeks the diet is more varied and the hot water is reduced to two quarts; lean mutton chops, turbot, whiting, green vegetables and rusks are allowed. During the next month the amount of hot water is reduced to one quart, and tea and captain's biscuits, the crust of stale bread, fish, fowl, game and joints of all kinds, with a little white wine and seltzer water, are allowed. At the end of this course of nine weeks a carefully arranged ordinary diet may be taken.

As a rule, it is not wise to bring down the weight of an adult more quickly than two pounds a week, unless he be content to remain in bed, or at least recumbent most of the time.

Specific Treatment.—In obesity either too much fat is produced, or too little is burned up in the ordinary course of metabolism. Either factor will produce an accumulation, and when they are both present the stoutness is apt to be great.

We can partially control the factor of production of fat by keeping our hand on the intake. It is possible to a certain extent to increase the katabolism by the use of thyroid extract. This agent is much used for this purpose, and, is on the whole,

very satisfactory, but it is well to remember that it not only hastens the oxydation of fat, but also of the protein of the tissues and hence attacks more than we are aiming at. Also, the other effects of the substance should be recalled, such as its hastening action upon the heart and general excitation of the nervous system. Still, when used with care, it is our most valuable medicinal agent in the treatment of obesity. The ordinary dose of the dried extract here is $\frac{1}{2}$ -1 grains t.i.d. While taking it the patient should be under observation and weighed at least once a week. Any symptoms of hyperthyroidism, or a fall in weight of more than at the outside a pound a day in an adult, should suggest a stoppage of the treatment or a lessening of the dose. Thyroid extract is not required, as a rule, in the exogenous cases, but only in those which resist treatment by dieting and exercise.

Many "antifat" remedies have been advertised from time to time, but they are all better avoided. Vinegar and alkalies have been much used for the same purpose, but they only produce loss of weight through deterioration in the general health, and should be discountenanced by the physician.

Symptomatic Treatment.—Anaemia is common in obesity and should be met with iron. Breathlessness on exertion is the most frequent complaint and is due partly to the patient having to carry so much weight and partly to the hampering influence of the fat about the heart. Carefully regulated exercises, always short of the production of any distress, are of use here. The Oertel method of treatment, as described under the heading of heart conditions, is of value. It consists in the moderate reduction of carbohydrates and great diminution in fluids, along with graduated walking exercises up grades. It tends to increase the efficiency of the heart muscle and to rid it of fat.

DIABETES MELLITUS AND GLYCOSURIA.

The presence of sugar in the urine may be a slight and passing affection; or it may be a very serious and persistent phenomenon, in spite of all treatment. Between these two extremes there are all degrees of severity.

The measurement of the percentage of sugar in the blood plasma is now a simple and routine clinical method, and it affords a much more accurate knowledge of the actual state of things than does its amount in the urine. This latter will vary with the threshold of the kidney for sugar.

Normally, the blood contains about 0.10 per cent. of glucose, and never exceeds 0.14 per cent. of this. In some instances where the sugar stands at the normal percentage in the blood it may appear in the urine, while in others it may not do so, although it is at a much higher figure than normal in the plasma. When a person shows sugar in the urine and yet the blood sugar is not raised, he is suffering from an increased permeability of the renal structures to sugar. The condition is an uncommon one, and is termed "Renal diabetes"; it is unaccompanied by polyuria or thirst or increased appetite. Under the action of phloridzin (a glucoside obtained from the bark of apple trees) a high degree of renal glycosuria may occur, even on a pure protein diet and when the blood sugar is not raised. The renal epithelium is evidently able to manufacture glucose under some conditions, and it is possible that in renal diabetes some toxin may be present which is thus causing it to act, or else it is due to a lowering of the threshold of the kidney for sugar.

If a normal individual ingests sufficient sugar he will show a temporary glycosuria. Usually a healthy adult can dispose of at least three hundred grams in the twenty-four hours without a rise in the blood-sugar sufficient to cause a renal leakage, but in many apparently healthy people this is not the case and glycosuria is easily thus set up, although it is absent when the carbohydrates are moderately restricted. When sugar appears in the urine only after the free consumption of carbohydrate the condition is termed *alimentary* glycosuria. Stout people of a gouty diathesis are specially apt to suffer from this form and can usually be kept free from it by a limitation of their carbohydrate intake.

There is a strong tendency for diabetes to run in families. This has been estimated by Williams¹ at eighty-five per cent., and in people with this heredity the power of metabolizing

¹*Amer. Jour. of the Med. Sc.*, 1917, II. 396.

sugar is poor and easily disturbed, and it is very important that the chief causes of the disease should be avoided as much as possible. These are (1) excessive consumption of sugar, (2) prolonged or sudden nervous overstrain and worry.

All the carbohydrates taken into the alimentary tract are turned into monosaccharides (chiefly glucose), and these are carried to the liver and the muscles and there stored as glycogen. The conversion of glucose into glycogen and its gradual change back into sugar again to meet the needs of the organism is largely influenced by certain internal secretions, especially that of the "Islands of Langerhans" in the pancreas, but also by those of the adrenal, thyroid and pituitary glands. The sugar metabolism is regulated by a nice correlation between the sympathetic, the pancreas, and the endocrine glands. The nervous influence is also a large one, and we occasionally see diabetes produced by a lesion at the base of the brain. One case is recalled where an engine-cleaner was struck on the back of the head by a suddenly-started wheel and quickly developed a severe diabetes which soon proved fatal.

In bad cases of the disease the tissues continue to produce sugar even when all carbohydrates have been stopped. The sugar must come from the proteins.

In diabetes, although the blood be laden with sugar it is not oxidized, apparently because some necessary ferment is lacking, and hence the tissues starve in the midst of plenty, and energy must be got from the burning of the proteins and fats. The fats are not completely burned and the products of their incomplete combustion accumulate in the blood and are poisonous. Beta-oxybutyric acid is the primary substance formed and is the source of acetone and diacetic acid, which will appear in the urine. The fat-content of the blood rises, and sometimes it may be so high that the blood plasma is creamy.

Diagnosis.—When sugar is discovered in the urine much work remains to be done before a complete estimate of the case can be made. The blood-sugar should be measured, and if it be raised then the rare form of renal diabetes can be excluded. The study of the sugar in the blood has been found to be a much more accurate gauge of the condition of the

patient than the measurement of it in the urine. It is now known that late in the disease the renal threshold for sugar tends to rise so that the blood-sugar may be as high as 0.2 to 0.3 per cent. and yet no glycosuria be present.

Is the patient stout and gouty, is he old or young? Diabetes in children is a much more serious condition than it is in old people. The effect of diet will show if the case be an alimentary one or not, and also will be a gauge of the severity of the condition in all instances.

In severe cases of diabetes, the caloric loss in sugar is enormous, and may amount to three thousand calories in the twenty-four hours.

Environment.—This largely depends upon the nature and the severity of the condition. In the slighter grades the patient may go about his ordinary duties, while in the severer ones he should, certainly at first, be kept absolutely at rest.

Generally speaking, exercise improves sugar metabolism, and hence should be advised as soon as the case has been thoroughly studied and the value of his diet has reached, perhaps, 2,000 calories.

All nerve strain and worry are very bad here, but unfortunately these patients are often introspective, and their spirits will fluctuate with the percentage of sugar in the urine. As hopeful a view of the condition as is justifiable should be presented, and in every way they should be encouraged and cheered.

A mild equable climate is best, as these patients suffer much from cold on account of their low heat production.

Regular weekly weightments are very necessary.

Diet.—The treatment of glycosuria and diabetes is largely dietetic. The patient has a lowered power of dealing with sugar, and the giving him more of this than he can assimilate only further weakens this capacity. If, on the other hand, he be spared this strain, by the cutting out of sugar-yielding foods, his weakened tissues (especially probably the pancreas) are rested, and when these foods are again gradually added it is usually found that he can now make use of more of them than formerly, without sugar appearing in the urine.

It is very necessary, then, that, if possible, we render the

patient sugar-free as soon as possible, and, then, upon this foundation, build up a diet that he can stand.

In slight cases of glycosuria, where the condition exists because the patient has been taking too much carbohydrate, all we need do is to cut this down and all will be well. These patients are very common, and it is important to treat them or they may drift into the worse condition of true diabetes.

The consumption of sugar per head of the population rose very much in the years preceding the war, and who knows if the rationing in many countries and the increase of the cost of it in all, may not have been a blessing in disguise to many persons who otherwise might exceed to the extent of causing disease. The limitation of diet in Central Europe certainly had a most beneficial effect in cases of diabetes, according to Elias and Singer, and they believe that the good was chiefly due to the *protein* restriction.

When first a patient comes under observation it is well to make no change in the diet for three or four days in order to allow time for the case to be thoroughly studied. Then, first the sugar, and then the starches are gradually cut off, when he may become sugar free, and remain so on a somewhat restricted diet. But if this be not the case, he must be put on a rigid regimen, such as the one given in Osler & McCrae's Medicine, page 431, arranged by E. P. Joslin.

Or the Allan starvation diet may be used. Here the patient is kept in bed, and given no food until the urine is sugar and acid-free. This usually takes from two to five days. As soon as the sugar disappears from the urine, carbohydrate food is gradually given, first in the form of green vegetables, and then by the use of others of higher starch content. Proteins and fats are cautiously added until sufficient calories are provided, always on condition that glycosuria or acidosis do not appear. If sugar reveals itself in the urine the fasting is resumed and then gradually food is added again. The fact that the patient loses weight is not significant. After the first few days, active daily exercise, carried to the point of healthy fatigue, is advised.

In commencing a starvation treatment it has been recom-

mended that the fats be cut out first and then the rest of the food. In this way acidosis is less likely to occur.

Certain starches seem less harmful than others, and the "oatmeal cure" and the "potato cure" have been advocated by many, but these articles should be tried with caution. Ordinary white bread contains 55 per cent. of starch. Various gluten breads are on the market, but most of them have more starch than is stated in the advertisements. Bread made from almonds is almost starch-free, and makes a good substitute for ordinary bread.

Lists of foods arranged according to their starch contents, can be found in any work of reference, and need not be given here.

Starchy vegetables, like potatoes, beets, parsnips, turnips, etc., can be rendered almost innocuous by several boilings in fresh waters, but they are insipid and have lost much of their food value.

In cases where it is difficult to meet the caloric requirements of the patient without causing glycosuria alcohol is of value. It should be given frequently in small doses rather than in infrequent large ones.

It is a good plan to add new articles of diet one at a time, always watching the effect on the blood and the urine.

If the patient misses the taste of sugar he can safely use saccharine, which is at least sweet, although to many it is a poor substitute.

Specific Treatment.—There is no specific treatment, in the strict sense of the term.

Symptomatic Treatment.—**Insulin.** It had for long been known that extirpation of the pancreas in dogs is followed by diabetes mellitus, and many attempts had been made to treat this disease by the administration of preparations of pancreas, but without success. The difficulty was that there are two secretions from the pancreas, that poured into the duodenum through the pancreatic duct, and that supplied to the blood (internal secretion), and when extracts of the whole organ were made the former secretion neutralized the effects of the second. A great step forward was made when Banting, in 1920, conceived the idea that it might be possible to obtain

an extract of the island tissues of the pancreas apart from that of the rest of the gland by causing degeneration of the latter by ligaturing the duct of Wirsung. After many technical difficulties had been overcome, with the collaboration of Macleod, Best and Collip, such an extract was obtained and was christened Insulin. This was found to have a profound effect in lowering the blood sugar and abolishing glycosuria in depancreatized animals. Later it was found possible to get insulin from the whole gland by extracting with strong alcohol.

The hopes raised by experimental work have been fully confirmed by clinical experience and it is now known that cases of diabetes mellitus can be freed from glycosuria by its subcutaneous or intravenous use. So far, it has not been possible to make an insulin that can be given by other routes. After the injection not only does the blood sugar become lowered and with it the glycosuria but the respiratory quotient rises and any previous ketonuria tends to disappear, and even those patients who are in a state of diabetic coma may generally be relieved.

Insulin is not advocated as a cure for diabetes mellitus, in spite of what the lay press would assume, but it is of great value as an aid in the treatment of the more advanced cases. In the complications that may develop in the disease, such as coma, infections, and surgical emergencies, it is often a means of saving life.

Banting, Campbell and Fletcher have emphasized the necessity of diatetic treatment in conjunction with the use of insulin, and, indeed, in the majority of cases suitable dietetic treatment alone is sufficient to establish a normal blood sugar level. When a patient, however, continues to excrete sugar after he has been on a properly balanced diet sufficient to cover his basal needs for a week or more, they believe, and the evidence is all in favour of this view being correct, that in insulin we have a body that is equalled by nothing else.

In most uncomplicated cases a unit of insulin will insure the combustion of two grammes of glucose. The unit is the amount of insulin that will reduce the blood sugar of a normal rabbit to 0.045 per cent.

Insulin is best administered shortly before a meal hour and it is well in severe cases to divide the total amount for the day into two or three doses. Overdoses, or even correct doses in some cases, may bring about hypoglycaemia, evidenced by nervousness, sweating, hunger, and various nervous and emotional disturbances; finally coma, with loss of deep reflexes. This condition is relieved by the administration of glucose or some readily available carbohydrate. In cases of unconsciousness the glucose may be given by stomach tube, or preferably intravenously, in 10 per cent. solution. Adrenalin is of *some* value, but it is not a substitute for the carbohydrates. Fortunately it has been found that in some cases the partial rest given to the Islands of Langerhans by the use of insulin results in some increase in the production of the internal secretion so that the dose of insulin may be lessened or even discontinued, and the patient may be able to get along on a carefully regulated diet.

It is hard just now to say exactly the position that insulin will occupy in a few years' time in the treatment of diabetes. The present view of its use, as put by Duncan Graham¹, is that "diabetes mellitus can be successfully treated in the less severe form by giving a properly balanced diet; in the more severe, by proper diet and the adequate daily dose of insulin."

The drug treatment of diabetes occupies a much less prominent position than was formerly the case. The only drug that has any decided influence in controlling the glycosuria is opium and its derivatives. Opium itself is the best here, and these patients stand it well. One grain given thrice daily will often lower the percentage of sugar and also the total amount of urine to a considerable extent. Thus, in a patient who had been under observation for years and who constantly passed about 100 ozs. of urine daily, opium was given to this extent experimentally for a couple of days on several occasions and always reduced the total urine by at least half and also lowered the percentage of sugar considerably. Codeine is often given instead and is less constipating but not so efficient. Sir Thomas Fraser found that the therapeutic power of one grain of morphia here equalled that of 15 grs. of codeine.

¹*University of Toronto Medical Bulletin*, April, 1923.

Opium or its alkaloids should never take the place of strict dieting and very often are not required, but they have their use in some cases.

Antipyrine, salol, the salicylates, belladonna and atropine have all been tried and extolled and they all seem to have some influence in lessening the sugar loss, but not to the same extent as opium.

Cambridge¹ has shown that opium and atropine have a remarkable effect in lowering the blood sugar, especially when they are given together.

Alkalies have been much used, and half an ounce of sodium bicarbonate daily is commonly given. The undoubted good effects of Carlsbad, Vichy, and many other waters in slight cases are probably due to the alkalies that they contain.

Cod liver oil, iron and laxatives may be used as required. Itchiness of the skin is often a trying symptom and is best met by alkaline lotions, such as one of bicarbonate of soda (a drachm to a pint), and a little carbolic acid increases the efficiency of this. Carbuncles are common and require special care. They are a not infrequent source of death amongst natives of India, who often suffer from diabetes. It is interesting to note that these people consume much sugar and other carbohydrates.

The urine of all diabetics should be frequently examined, not only for sugar, but also for beta-oxybutyric acid and acetone and any increase of ammonia. These are precursors of diabetic coma, from which about two-thirds of all the cases die. Any symptoms of this should be met by a reduction of the diet, especially the fats, and by the administration of insulin or of large quantities of sodium bicarbonate. In slight cases this salt may be given by the mouth in doses of one drachm every four hours, but when any urgency exists it should be introduced intravenously, using a two per cent. solution in normal saline. As much as a litre of this may be thus given every six hours in desperate cases. It is only fair to add that some authorities (e.g., Joslin) do not favour the use of sodium bicarbonate as a routine treatment of acidosis.

When diabetic coma is fully established the outlook is

¹*Lancet*, Dec. 23rd, 1922, p. 1324

grave, but temporary improvement may be looked for under treatment, especially with insulin combined with glucose.

SCURVY.

This disease is now a rare one, but it was once a curse of armies and ship's crews, and many an exploratory and military expedition has been wrecked by it. In Lord Anson's voyage round the World in 1740 to 1744, 380 out of 510 died of it.

Various theories have been held as to the causation of the disease. Thus, it was believed to be due to lack of potassium salts; to some toxin in the food; to the absence of some element from the food; to an acid intoxication, or as dependent upon a specific infection. It was always the food that was blamed, as it was found that the disease did not occur if sufficient fresh food (either animal or vegetable, but especially the latter) was taken, and in cases that had occurred the trouble generally quickly disappeared if such food was given. Thus, lime juice was found to nearly entirely prevent its occurrence upon board ship, and from early in last century a daily ration of this was compulsory on all long voyages.

Within the last few years, it has been shown that it is the absence of *vitamins* from the diet that is the essential cause.

Vitamins have been classified by various writers into "fat soluble" A and "water soluble" B and C. The former are largely contained in butter, fat and cod liver oil, the yolk of eggs and the leaves of vegetables; the latter in milk and fresh vegetables. It is the absence of water soluble C vitamin that brings about scurvy.

Scurvy is still occasionally seen, especially in infants who have been fed upon artificial food. Crowding, bad air, mental depression, and physical exhaustion are all predisposing causes, but, as said, the essential factor seems to be the absence of vitamins. There must be a large individual idiosyncrasy to this cause, as in a group of men under exactly similar conditions, only some will be affected by the disease. Possibly a micro-organism is the final determining cause, and, certainly,

secondary infections usually occur, and often at last carry off the debilitated patient.

In scurvy there is a calcium retention while the opposite is the case in rickets.

Diagnosis.—The anaemia, spongy gums and tendency to haemorrhages all make the well-developed case easy of recognition, but slight degrees of it may be overlooked, and the diagnosis only confirmed by the curative effects of fresh food.

Environment.—The patient should be kept at rest, and carefully protected against any injury, as a trifling bruise may cause a severe subcutaneous haemorrhage.

Fresh air, sun-light and cheerful surroundings are all very necessary.

Diet and Specific Treatment.—These may be taken together, as they are the same thing here.

The patient should be given abundance of fresh milk, with fresh vegetables, and diluted orange or lemon juice. Often at first the state of the gums will prevent the proper mastication of solid food, and the above are all that can be taken and are all that are required to quickly bring about a change.

As soon as the patient is able, he may be allowed solid food, with plenty of potatoes, cabbage, lettuce and fresh meats. Investigation at the Lister Institute showed that germinated seeds, such as peas and beans, were specially antiscorbutic; and H. W. Wiltshire found, in treating the disease in Serbian soldiers, that beans, allowed to germinate for forty-eight hours, and then boiled for ten minutes, were more effectual than lemon-juice in rapidly relieving the condition.

It has been recently found in von Pirquet's clinique in Vienna that the prolonged cooking of vegetables largely destroys their anti-scorbutic properties.¹

The length of time of heating rather than the degree of heat is the destructive factor. Hence Pasteurization is worse than boiling. Lime juice was formerly believed to be very anti-scorbutic, but lately it has been conclusively shown that it has little action in this respect. The only explanation of why it seemed to act so well in the navy is that lemon juice must have been substituted for it and lemon juice is very

¹*Brit. Med. Journal*, 1920, II, page 546.

potent. Lately Bassett Smith¹ has been able to concentrate lemon juice at room temperature and the syrupy liquid that results retains its anti-scorbutic powers. It can be made into tablets and these are still active a year later and should be of great value in exploratory expeditions.

In infants upon artificial food, even when this consists of cow's milk that has been only pasteurized, some orange-juice should always be given daily, and thus the danger of scurvy may be entirely avoided. At the Hebrew Infant Asylum in New York it was the custom to feed the babies on milk pasteurized for thirty minutes at 145 degrees Fahr., and to add some orange juice. No scurvy occurred, but when the orange-juice was omitted for three months the disease became common, and it was rapidly got rid of when the antiscorbutic factor was restored. For children over one year of age a potato gruel is useful.

Symptomatic Treatment.—The above alteration in the diet will usually quickly clear up the symptoms, but, if the tendency to haemorrhage is great, calcium lactate may be given in doses of ten grains every four hours.

There is frequently much anaemia of a secondary type, and iron will be required, best in the form of the saccharated carbonate or the syrup of the iodide of iron.

The spongy or sloughing gums may require special care. They may be painted with a ten per cent. solution of silver nitrate, followed by a mouth-wash of weak permanganate of potash or of 1-40 chlorate of potash. If bleeding from them be profuse the bleeding points may be swabbed with 1-1000 solution of adrenalin.

There is often great asthenia, and the patient should be very slow in getting about, as syncope is apt to occur. A tonic containing strychnine is useful at this stage.

RICKETS.

This is a disease of large cities, where impure air, insufficient sunshine and over-crowding are likely to occur, but the essential cause is one of diet, and the trouble may be met with

¹*Lancet*, Aug. 13th, 1921, p. 221.

anywhere, even in the country and in the homes of the rich. L. Finley¹ computes that at least half of the children in the industrial population of Great Britain are affected by it.

The disease rarely begins before the sixth month and is seldom seen for the first time after the second year of age, although a peculiar type called "late rickets" was described by Jenner as occurring as late as the age of twelve, and such cases are occasionally met with still.

Rickets is practically never seen in children who are entirely on the breast, and even partial nursing largely prevents its occurrence.

The deficiency of fats, and of proteins, was long thought to be the cause of the disease, as these elements were usually found to be deficient where the disease occurred, but now it is believed that it is the absence or deficiency of vitamins which is the essential cause.

The disease directly results from an inability to digest improper food, which contains an excess of carbohydrates and a deficiency of fat. A lack of the "fat-soluble A" vitamin has been regarded as the cause of the disease.

A deficiency of phosphorus or of calcium or of vitamin A alone will not produce rickets in experimental work on rats, but a combination of these factors will do so.²

As one would expect, rickets and scurvy often occur together, and the combination is called Scurvy-Rickets.

Rickets is largely a disease of the bones, which show a great diminution in lime salts, with consequent softening; but the prominent abdomen and enlargement of the liver and mesenteric glands are also characteristic.

Diagnosis.—Mild grades of rickets are often overlooked, but otherwise the condition is easily recognized. Delay in dentition or in walking, and any tenderness of the long bones, should always raise a suspicion of the probability of the disease.

Environment.—The child should be put in the best hygienic surroundings possible, and sunshine and fresh air are invaluable. It has been shown experimentally in animals how the

¹*Glasgow Med. Jour.*, May, 1918.

²F. F. Tisdall. *Can. Med. Assoc. Journal*, December, 1921.

absence of these will predispose to the disease. Sunlight or ultra-violet rays appear to act like vitamin A in preventing or curing rickets.

Diet and Specific Treatment.—These are similar and may be considered together.

As already said, breast-fed children are seldom affected, and when the mother cannot nurse her child a wet-nurse should, if possible, be provided. Failing this, fresh milk, properly modified to meet the digestive state of the infant, is the best food. Raw beef-juice is valuable as an addition, and the daily use of orange-juice is grateful to the infant, and will lessen any tendency to superadded scurvy.

That a strong idiosyncrasy exists towards the disease is shown by the fact that if a number of infants are fed in exactly the same way on an improper diet only an occasional one will develop rickets.

Symptomatic Treatment.—The care of the digestive tract is all-important, and some children may develop rickets on a theoretically perfect diet because they are not properly assimilating what they swallow. Any gastric or intestinal catarrh must be carefully treated. In slight cases of disorder here the time-honoured use of rhubarb and soda is valuable. One grain of the former to four of the latter may be given thrice daily before feeding to a child of one year. Often half-grain powders of *hydrargyrum c̄ creta* night and morning are useful.

The administration of cod liver oil quickly causes an improvement in the general condition of these patients, with rapid increase in the deposit of lime salts in the bones. The oil contains an abundance of vitamins and probably owes its virtue chiefly to this. In case of extreme wasting the inunction of the oil through the skin not only helps the nutrition but also no doubt is valuable as a form of massage.

Rickety children are often fat and pallid and in such the syrup of the iodide of iron or the saccharated carbonate are useful. Lime salts are often given, but the trouble is not so much the deficiency of these in the diet as the inability of the child to assimilate what it takes.

Phosphorus is of some value in improving the nutrition and the hardening of growing bone, and the child of one year

may be given the B.P. oil of phosphorus in one minim doses twice daily, often well combined with cod liver oil. B. P. Hoobler¹ states that cod liver oil lowers both the absorption and retention of calcium, but that milk raises both. Alan Brown has shown, however, that the use of cod liver oil without phosphorus produces a rise in the calcium-content of the blood, with a corresponding reduction in the mechanical and electrical irritability, which is very important in these patients in whom tetany and laryngismus stridulus are so apt to occur.

It is wise to discourage the child from walking as long as possible, as the softened bones can ill stand the weight, and tend to bend. In severe cases, the patient should be kept horizontal for a long time, as the spine may otherwise suffer. Gentle massage, hydropathy and electric stimulation of the muscles, are of some value in such cases, in place of exercise, in promoting the nutrition. As said, rickety children are particularly prone to tetany and laryngismus stridulus, and also to respiratory complications, and must hence be watched with special care.

The active signs of rickets disappear after the age of two years, and only the deformities remain. These are benefited by gymnastic exercises and massage, and later by the use of mechanical appliances, such as splints and braces.

The severe bony deformities can usually only be lessened by operative treatment.

¹*Osler Memorial*. Volume II, p. 853.

CHAPTER XXVII.

FUNCTIONAL DISORDERS OF THE NERVOUS SYSTEM.

NEURASTHENIA. HYSTERIA. HYPOCHONDRIASIS. INSOMNIA.

General Remarks.—Disturbances of the nervous system are produced by any abnormality in any part of the body, for it is only through the nerves that we appreciate any sensation. Hence it may be said that any disease anywhere causes functional nervous trouble in that the nervous system is disturbed and the patient is conscious of pain or distress.

A man has a carious tooth and suffers from trigeminal neuralgia; another has a sarcoma of the spine and complains of "sciatica"; a third, probably a child, has a round worm in the intestine and shows nervous symptoms even amounting to fits, all of which may be relieved by the timely use of *santonin*.

All nervous symptoms are due to (1) organic changes in some part of the nervous system itself; (2) irritation or disturbance of some part of this system from toxins or from psychic influences; (3) or to disease in other organs, but in this case we really have disease of the nervous system. For example, in the case of dental caries, irritation and probably inflammation of the nerves in the vicinity of the tooth are responsible for the pain. The afferent impulses from the irritated nerve endings here set up further disturbance in the central nervous system and may thus produce symptoms which appear as if they originated centrally.

It is customary to divide diseases of the nervous system into (1) functional and (2) organic, but as the methods of pathological examination improve more and more of the former are found to belong to the latter class; and some would argue that all symptoms are due to some physical change, although as yet these are far too delicate to be recognized by any examination of the nervous tissues.

It is important to remember that even when some organic lesion exists most of the symptoms may be of so-called func-

tional nature. For example, a patient has a tumour of the brain or a latent abscess there and yet for long may only show what appear to be hysterical symptoms. Most physicians have been deceived in this way. In war practice one constantly saw some slight lesion associated with functional disturbances which were not due to the injury, but to the very powerful influence of suggestion.

FIGURE IV.



In treatment it is all important to remember that even when organic disease exists many of the symptoms may be functional, and usually removable if properly treated. The idea may be diagrammatically shown as in Fig. IV.

Upon a slender organic base is often built a great superstructure of functional symptoms which may all be cleared away by skilled treatment, leaving only the organic basis which now is of little importance.

The treatment of nervous disease has become largely a special subject and nothing more will be attempted here than an outline of what the general practitioner should know.

Functional nervous affections may be due to a variety of causes:—

(1) Toxaemia, the toxin being introduced from without, as in the case of alcoholism, cocaineism, etc., or produced within the alimentary canal, or in the tissues from errors in metabolism. An example of alimentary toxaemia is the headache occurring in dyspepsia and constipation. Pardoe has shown that neurasthenia and some mental disorders occur in direct association with indoxyluria and disappear when the elimination of indoxyl is reduced. An example of metabolic toxaemia is the nervous irritability seen in gout. It was noted by B. H. Shaw that some attacks of delirium, confusional insanity and melancholia, synchronizing with acetonuria, yielded rapidly to an alkaline treatment. The toxins found in the cerebrospinal neurones subjected to strain—cholin, phosphoric acid

and particularly neurin—are highly poisonous substances and upset mental equilibrium.

The whole mental outlook of a man may be changed from one of pessimism to normal by the administration of a blue pill. The psychic state of a patient dying of tuberculosis is apt to be quite different from that of one dying of gangrene. The two are equally near death and both are probably free from pain, but the first is under the influence of a toxin that promotes cheerfulness (he has the *spes phthisica*), while the second is under a depressing toxin and is hence down-hearted.

(2) Or the functional disturbance may be reflex, where the nervous system is deranged by afferent impulses coming from different parts of the body; and it, in its turn, sends out impulses which cause symptoms elsewhere. Reflex tic is an example of this type and also fits occurring from some reflex cause, such as a tight prepuce.

(3) Very many functional diseases are purely psychic. They may take the form of disturbances in the emotions, or of the various anxieties and phobias, or appear as motor or sensory derangements.

“There is nothing either good or bad but thinking makes it so.” The patient thinks that he cannot move a limb and probably he is unable to do so; he believes that he has no feeling, and pins may be stuck into him up to the head and he does not wince.

Pure belief will not only produce subjective symptoms but may even cause physical changes which can be gauged by observers. As will be mentioned later, suggestion can raise the temperature of a limb and even produce blisters, so great is the effect of the mind on the body.

The three best marked types of nervous disease are hysteria, neurasthenia and hypochondriasis.

In Hysteria there are a great variety of sensory, motor and psychic phenomena due to the effects of suggestion upon an unstable nervous system. The suggestion may arise in the patient's mind or come from without.

In Neurasthenia there exists nervous exhaustion or toxæmia (which may be the same thing), causing a mixture of irritability and weakness.

Psychasthenia is the term used for a neurasthenic state where two factors are at work, (a) a pre-existing, innate, and usually inherited weakness, and (b) a superimposed nerve exhaustion. It is much more difficult to treat than is pure neurasthenia.

In Hypochondriasis one finds unfounded belief in the presence of some disease. Sometimes the condition merges into insanity, but many slight instances of it are seen at every health resort, and these hypochondriacs haunt the consulting rooms of many fashionable physicians or spend their time and money in the pursuit of health through every new system of "cure."

These three types of functional nervous disease are clearly defined in text-books, but in practice they often merge into each other and are ill-determined, and Dubois calls them all cases of "nervousness," and there is much to be said for this practical grouping.

Diagnosis.—It is important to recognize that these functional conditions are realities and require treatment just as much as do those due to organic disease. It is useless to tell the patient that there is nothing wrong with him, for he knows well that there *is* something amiss.

Before coming to the conclusion that the condition is functional, a very thorough examination and enquiry into the history should be made. This has the effect of establishing the diagnosis, and, further, when at last one is able to tell the patient that there is no organic disease present, he will be more convinced than if this be said after only a cursory and hurried investigation. His confidence will have been gained, and this is half the battle in such cases.

As already said, there may be some organic affection present and yet most of the symptoms may be functional and quite curable, and this should be explained and impressed upon the sufferer. An intelligent patient may with advantage be shown Diagram IV. (page 416).

In my experience, true Malingering is rare, but half-conscious exaggeration of symptoms is very common, especially in military and accident work, where an illness carries less financial disability than when the patients are working for

themselves. When such exaggeration is detected the patient should be made to see that this is the physician's opinion, and he should be firmly but kindly told to make the least rather than the worst of his condition.

Where the symptoms follow some injury, such as a blow on the head, a railway accident or a near-by explosion, it is well to ask the patient if he can recall the event. If he can clearly do this it is not likely that there was any true concussion, as this usually wipes out the memory of events for some time preceding it. When soldiers were able to describe the explosion of the shell and then later became unconscious and developed other nervous symptoms, the chances were that the whole condition was functional and not due to any physical effects of the injury. It was the auto- or hetero-suggestion following the shock that produced the symptoms.

A very common type of nervousness is shown by the woman who suffers from constant abdominal symptoms. She is usually an elderly spinster or a childless wife and her whole mind centres round her abdomen. She is what Robert Hutchison¹ speaks of as the "abdominal woman." Probably she has had her appendix removed, adhesions separated, and often many other operations. Each of these has caused temporary improvement, but the symptoms return, for there is nothing wrong with the abdominal organs and the trouble is psychic. Such patients wear out their friends and their physicians.

The Treatment of "nervousness" resolves itself into four factors:—the application of rest, proper feeding, the elimination of toxins or sources of reflex disturbance, and last and generally the most important, the psychic handling.

Environment.—This is often the most valuable part of the therapy, if it be taken to include the whole psychic surroundings of the patient, including the physician's bearing towards him.

Psychotherapy has existed as long as any treatment has been in vogue, and is practised consciously or unconsciously by everyone who deals with the sick. A man is largely how he feels, and feeling is largely a matter of suggestion. Tell him that he looks ill and he will feel ill; suggest that he seems well

¹*Brit. Med. Journal*, April 21st, 1923, page 667.

and he will tend to be so. Everyone is more or less open to such suggestion, but when the nervous system is from some cause unstable it is much more easily affected than usual, and then wise suggestion will influence the patient for good and bad suggestion for evil to a marvellous extent. As Dubois puts it, "The nervous man is on the path to recovery as soon as he has the conviction that he is going to be cured."

Galen said, "He cures most successfully in whom the people have the greatest confidence."

The physician should try to establish this confidence, first of all by a patient and sympathetic hearing of the symptoms, next through a thorough and systematic examination, and finally by a confident and optimistic bearing in giving the results of the investigation. A medicine given to a nervous patient with the remark, "Here is the very thing that you need, and you will soon be all right," may cure, when if the same be prescribed with the comment, "You might try this, but I doubt if it will help you much," it will fail. Such is a crude way of putting the fact that it is confidence in our remedies which often in these cases is the chief factor in their action. This helps to explain how many treatments are firmly believed in by some practitioners and found of little avail by others. The former manage to convey their confidence to their patients, and it is this confidence which works the cure.

Everything which will increase the faith of the patient in the treatment adopted will increase the good action of that remedy.

One nervous person may be relieved by a visit to some famous sacred pool, another by the anointing with sacred oil, another by prayer and yet another by a bottle of medicine or a hypodermic injection of water. In all these the same force brings about the change, and that is faith.

Most psychic treatment is suggestive, and some persuasive. Suggestion is the introduction into the patient's mind of ideas which modify his mental state. As already said, suggestion may be good or bad. When a nervous patient is asked if he can move his legs, the idea is suggested to him, perhaps for the first time, that possibly he may not be able to do so, and hysterical paraplegia may result. Such is an example of

bad suggestion and in military practice it was seen very often. Few cases at the front suffered from paralysis or anaesthesia, but these symptoms supervened later as the result of suggestion.

The typical symptoms of hysteria are usually seen in much-studied cases. Babinski failed, in one hundred consecutive cases of hysteria, not previously examined by physicians and in which he was careful to avoid suggestion, to note in a single instance the presence of hemi-anaesthesia. The same thing has been found in the contracted fields of vision that used to be made so much of in these cases.

Suggestion will not only produce subjective phenomena but also symptoms and signs that can be measured. Thus, J. A. Hadfield, not long ago, noted the occurrence of blisters as the result of suggestion, and recently¹ has shown that he could raise or lower the temperature of a limb by many degrees through this alone. It is probable that the whole body-temperature can be raised through nervous influence, and that hysterical fever may be so explained.

Suggestion of this kind is called Heterosuggestion: but Autosuggestion is also very common, where the patient, seeing, perhaps, a wound on his leg, thinks that he cannot move the limb and promptly it becomes paralyzed, and probably will remain so until a stronger heterosuggestion convinces him that he can move it, and thus he is cured.

Persuasion means more than suggestion in that we convince the patient by explanations that appeal to his judgment that his condition is curable. An intelligent patient can thus be brought to see the origin of his trouble and the way to get rid of it, and may thus react better than from mere suggestion. On the other hand, in some patients, a blunt order will have more effect than anything. So much depends upon the mental make-up of the individual.

The good effects of surgical intervention are often entirely psychic and one frequently sees great benefit from an exploratory incision alone.

In psycho-therapy three elements are necessary, which were well put by Osler: "First, a strong personality, in whom

¹*Lancet*, 1920, II, 68.

the individual has faith—Christ, Aesculapius (in the days of Greece), one of the saints, or, what has served the turn of common humanity very well, a physician. Secondly, certain accessories—a shrine, a sanctuary, the services of a temple, or for us a hospital or its equivalent, with a skilled nurse. Thirdly, suggestion, either the ‘only believe,’ ‘feel it,’ ‘will it’ attitude of mind, which is the essence of every cult and creed, or the active belief in the assurance of the physician that the precious boon of health is within reach.”

There is a great deal of sense in the old *Punch* joke of an aged woman handing back a clinical thermometer to the doctor, with the remark, “Ah, doctor, that did me a power of good!”

Paracelsus said, “Whether the object of your faith is real or false, you will, nevertheless, obtain the same effects. Faith produces miracles.”

Bad cases should be kept in bed, and often a strict Weir Mitchell course is of value. Here absolute physical and mental rest is enjoined, with complete isolation, the patient seeing no one but her doctor and nurses. The nurse is a most important factor here. These patients are always introspective and have a morbid craving for sympathy, and this abnormal mental state must be dealt with by the nurse, who is in constant attendance upon her, and she must have sympathy and cheerfulness combined with firmness or she will be of little use.

Change of air and travel are often helpful in slight cases. Social duties are frequently a great strain on these people and if so should be lessened or prohibited, and this can often only be done by their removal to strange surroundings.

In the milder cases and in all during convalescence, games, hobbies of some kind and employment are of the greatest importance. They exercise the muscles and the circulation and take the patient’s mind off his condition and into healthy channels. A man can learn to divert his mind from an unhealthy train of thought by deliberately thinking of other things, and the intenseness of the undesired thoughts will then subside. In no way can this be better done than by amusements, instruction and occupations.

A neurasthenic who has nothing to do all day but to think

of his condition is a miserable object, and the more he can be got to take an interest in things outside himself the better will he be both physically and mentally.

This was found to be the case in the army, and in all convalescent camps games of all sorts were encouraged, industries were carried on, and the patients urged to thus employ themselves. And all this was looked upon as a very valuable part of the treatment. As Sir J. Crichton-Browne says: "Much sound psychotherapy lurks behind the sweat of the brow."

At first, the games and employment must be very light, but gradually, as improvement occurs, more strenuous ones may be used.

Even healthy people, if forced to do nothing, become wretched, and the same blank environment acts even more surely on these susceptible nervous people.

Occupational Therapy is hence of great value, and the recent advances, largely stimulated by War experience, that have been made in its systematic development cannot be too strongly commended. Everybody should have something to do, but this is specially important for the convalescent. The good effects are partially physical but very largely psychical.

Diet.—As a rule, nervous patients are under-nourished and in consequence should be fed up in every way. This may be difficult at first as the digestive organs share in the general weakness and there is often vomiting. Milk in some form should form the bulk of the diet.

Many of the slighter cases can be on an ordinary diet, with some tempting extras added, but in the severe ones, where rest is essential, a strict regime should be instituted. The one recommended by Dubois is excellent, and is given here:—

At	7	9	11	1	3	5	7	9	o'clock.
1st Day	3	3	3	3	3	3	3	3	ozs. of milk, making 24 ozs. in 24 hrs.
2nd Day	4½ ozs. at each feeding, making 36 ozs. in 24 hrs.								
3rd Day	6 ozs. at each feeding, making 48 ozs. in 24 hrs.								
4th Day	9	6	6	9	6	6	9	6	ozs. of milk, making 57 ozs. in 24 hrs.
5th Day	12	6	6	9	6	6	9	6	ozs. of milk, making 60 ozs. in 24 hrs.

6th Day ditto, plus bread and butter and sweets at first meal.

7th Day Three good meals, with milk between them.

It is well for the nurse to adhere strictly to the hours of this schedule as it is a useful discipline. The physician should as far as possible dispel the idea of milk not agreeing, and should tell the patient to ignore slight discomforts. If vomiting occur after any feeding the meal should be repeated and will then usually not be again rejected. If, however, it be persistent, gastric sedatives, such as bismuth or chloretone, may be necessary for a time, and in hysterical cases the use of the stomach-tube is often a valuable deterrent.

Specific Treatment.—The removal of the cause of functional nervous disease is a wide subject. By the time the patient consults his physician it may have acted and produced symptoms and now be over, but in very many instances it is still at work and if removed the condition may soon clear up.

A man gets a sudden fright or shock, as when a shell explodes near him or some terrible sight or news reveal themselves, and the cause is already over before he consults his doctor, if only he can be protected from bad suggestions later, and this is a very large "if." But in the worn-out neurasthenic who is harassed by business or domestic cares and worries (every one of which now seems exaggerated), the removal of him from these surroundings is for him specific treatment.

Again, when the system is continually poisoned by alcohol, gout or some less definite but quite as powerful toxin, such causes must be removed or lessened before he can be expected to improve.

There are many examples of the "vicious circle" in functional nerve troubles. A neurasthenic sleeps badly and during his sleepless hours all his troubles become magnified, and the result is that next day he is even more tired and irritable and less able for work, and so on the following night sleeps worse than ever. Here we may break the vicious circle by the use of an hypnotic, and after a good sleep so induced he is better next day and more able to face his work and worries, which now seem smaller, and so may soon sleep naturally.

Worry, eye-strain, dyspepsia, constipation, anaemia, displaced organs, may be mentioned as common and often re-

movable causes. In railway neurasthenia (or hysteria) it is often the worry and uncertainties in connection with an impending law-suit which keeps up the symptoms, and when the case is settled in the Courts, even if the damages be less than were hoped for, the symptoms generally largely clear up. This does not mean that the patient was malingering, although, of course, such often occurs.

Psycho-analysis may rank as a specific treatment in that the hidden cause of some nervous trouble may thus be unearthed and, being brought to light, loses its venom. But in many instances the cause is not forgotten and the patient, by brooding over his condition and exaggerating some idea and often reading with avidity much quack "literature", at last becomes a nervous wreck, and if the physician can only get his confidence and, after hearing the halting confession, let the patient see things in their true proportion, he will do much to remove the cause of the trouble. The doctor must often act the part of a father-confessor. But psycho-analysis goes deeper than this and by careful analysis of the patient's story may unearth some idea that has for long been suppressed and finally forgotten and yet in the sub-conscious self of the patient still exerts its evil influence. Freud greatly elaborated this system and extended the idea until he would have us believe that all functional nervous manifestations are the result of suppressed emotions of sexual origin. Few will go as far as this but there is a good deal in the idea of many nervous manifestations being perverted reactions of the organism to suppressed and often completely forgotten emotions.

Symptomatic Treatment.—The symptoms of functional nervous trouble are legionary. They may be referred to any of the organs of the body or be purely psychic and take the form of various phobias and anxieties. The patient finds it hard to adapt himself to his environment. He may feel himself to be a "misfit" and knows there is something wrong. Many of the symptoms will require special treatment, but, as a rule, the patient should be taught, as far as possible, to ignore them. Many an abnormal sensation even amounting to pain will get less and finally disappear from the field of con-

sciousness when the patient is assured that it is not of serious omen.

As already said, the psychic treatment is all-important and if only the sufferer can be got into the proper psychic poise he is now on the way towards cure.

Besides all the psychic environment already referred to, Hypnotism is sometimes employed. These patients are as a rule very easily hypnotized, and they may, when in this receptive state, be persuaded that their symptoms do not exist, and the effects remain after they have come out of the hypnotic state; but, on the whole, hypnotism has gone out of favour except with a few, as the results are not well maintained. In any case, it is a form of therapy that should only be attempted by those having the special knowledge necessary.

Tonics are often needed, according to the special indications: iron in the anaemic, bitters where the appetite is poor, and so on.

Phosphorus is much used in nervous debility. In many of these cases the loss of phosphorus is much above the normal, and it is supposed that this loss may be made good by the administration of the drug by the mouth.

There is no doubt that phosphorus has a profound effect upon tissue growth and nutrition. Thus, cattle fed upon food poor in it, such as potatoes and certain roots, fail to fatten properly and become weak. It also affects the growth of bone and causes increased thickening and hardening of the compact tissue here. It seems to improve the nutrition of the nerves and is given for this purpose in cases of nervous debility. The dose of phosphorus is 1/100-1/25 gr. and it may be given in pill form or as the official oil, each of which contain 1% of the drug, and hence the dose of the pill is 1-4 grs. and of the oil 1-4 mins.

The various phosphates and hypophosphites do not seem to act as phosphorus and should not take its place.

Arsenic is used for the same class of case, and also in chorea, where there is much clinical evidence of its value.

Arsenious acid is often given in pill form in doses of 1/60-1/15 gr. or as Fowler's solution in doses of 2-8 mins.

Alimentary symptoms, such as dyspepsia and constipation

(and more rarely diarrhoea) are very common in nervous cases and are usually of functional origin and must generally be treated with this point in view; but, at the same time, they may for a time require some local treatment of a medicinal nature. In these patients the stomach and bowel may both be largely trained to behave normally, and this view should be impressed upon the patient. "I wouldn't be ruled by my stomach," "I wouldn't be beaten by my bowel," are remarks that the physician can sometimes humorously make to these patients with far-reaching results.

In atonic conditions of the nervous system, where the patient is limp and always tired, strychnine is frequently of value. In an investigation made several years ago, in England, it was found that the most frequently prescribed pharmacopoeial preparation was the tincture of *nux vomica*. This owes its activity chiefly to its strychnine content.

Strychnine is quickly absorbed from the alimentary tract and rather slowly excreted, so that it tends to be cumulative. In the mouth and stomach it acts as a bitter and stomachic and is much used for this purpose, but its chief action after absorption is upon the receptive cells of the motor reflex areas, so that the reflexes are rendered more active, and if the dose be a poisonous one spasms occur closely resembling those of tetanus. The special centres are rendered more acute, so that the field of vision is widened, finer shades of colour can be detected, and hearing and touch become more delicate. The tonic action upon the circulation is also of value here. The total effect of medicinal doses is to increase the sense of well-being. The preparations of *nux vomica* are the extract (dose $\frac{1}{4}$ -1gr.) the tincture (dose 5-15 mins.), the liquid extract (dose 1-3 mins.) and Strychnine Hydrochloride (dose $\frac{1}{64}$ - $\frac{1}{16}$ gr.) The *liquor* of this is a 1% solution and the dose is 2-8 mins.

Strychnine is generally indicated where there is limpness and asthenia, but is not of value and often, indeed, does harm, where the patient is restless and excited, with increased reflexes. Some people have an idiosyncrasy to strychnine and a very small dose may produce considerable excitement.

Where nervousness takes the form of restlessness and ex-

citability, Bromides are generally indicated. The dose of the official bromides (viz., those of potassium, sodium, ammonium and strontium) is 5-30 grs., but on occasion these amounts may be much exceeded without causing any untoward effects.

Bromides are rapidly absorbed and slowly excreted by the bowel, the kidneys and the skin. Their effect therefore tends to be cumulative.

They dull the nervous system, especially the afferent tracts and cells, and their action is greater on the brain than on the spinal cord. They are mildly hypnotic, as long as there be no pain, in which case they are useless. There is not much difference between the various bromides, but the potassium base is supposed to be slightly depressing, the ammonium stimulating, and the strontium has a stimulating effect upon non-striated muscle and hence may be preferred where a hyptonic state of the stomach exists. All these kation effects, however, are slight in medicinal doses taken by the mouth.

Bromides act better when they partially replace the ordinary sodium chloride intake, and this should be remembered when we wish quickly to get their full effect. They all tend to produce various skin eruptions, especially acne, and this undesirable effect may be lessened or prevented by giving small amounts of arsenic along with them. Such a prescription as the following is useful:—

R	Stront. Bromid.	5iij.
	Liq. Arsenical.	5ss.
	Ext. Glycyrrhiz. Liq.	5ss.
	Aq. Camphor.	ad 5vj.

Sig.—A tablespoonful in water thrice daily after meals.

The use of bromides in mildly excitable cases may be compared to the employment of splints in the case of fractures of bones:—the nervous system is, so to speak, splinted, and the partial rest thus given is used by Nature for the restoration of the jaded nerve cells.

In the wilder states of excitement of hysteria, Valerian and Asafoetida are often employed. The effect of these unpleasant-tasting and smelling drugs is no doubt partly moral, but they also have a sedative action. The doses of the ammon-

iated tincture of valerian and of the tincture of asafoetida is 30-60 mins and this may be repeated as often as every four hours as required.

The Weir Mitchell system of treatment is often of great value in bad cases of neurasthenia. It consists in absolute rest, isolation, over-feeding, massage, hydropathy and electricity. In it, as already said, the nursing is a most important feature. The patient is cut off absolutely from former associations, and in the midst of firm and sympathetic surroundings gradually starts life again in better physical condition and also free from the mental twists that have occurred.

A modified rest cure is often useful for the hard worker who has broken down under the strain, and may consist simply in shorter hours of work and longer hours of complete rest, especially the taking of a two hours' rest in the middle of the day and perhaps the whole of Sunday completely in bed.

There are certain manifestations of nervous trouble which can conveniently be discussed here as entities. Such are insomnia, pain, headache and neuralgia.

INSOMNIA.

Insomnia is a relative term, and the condition may be said to exist when an individual gets less sleep than is required for his special economy. Absolute insomnia is impossible for long: a man must sleep or go insane and soon die. He may go for weeks without food and yet live, but cannot do without sleep for more than four or five days.

We do not know what sleep is, but we do know that it is essential to life, and no more terrible punishment can be inflicted upon anyone than to deprive him of it. One quarter to one third of a man's existence is spent in this oblivion, during which various adjustments and chemical changes take place to enable the body to carry on in its hours of activity.

The amount of sleep required by different individuals varies, some adults being content with five or even four hours while others need seven or eight. Healthy infants spend most of their time in sleep.

The causes of sleeplessness are numerous and may be classified somewhat as follows:—

I. Where the nervous system is so hypersensitive that very slight afferent stimuli may prevent sleep. Such hypersensitiveness may be due to:—

(a) Inheritance. Some families are notably light sleepers.

(b) Fatigue or neurasthenia.

(c) Exciting toxins, produced in the body or the alimentary canal by infections or metabolic disorders, or introduced from without.

(d) Circulatory conditions, especially aortic regurgitation and arterio-sclerosis.

II. However stable the nervous system is, sleep may be prevented by too many or too powerful afferent impulses reaching it, such as bright light, noise, cold, heat, discomfort anywhere in the body, and acute thoughts, especially of a worrying nature.

It is evident that if the nervous system be hypersensitive, slighter afferent stimuli will be sufficient to induce insomnia than if this hypersensitiveness does not exist. In some instances it seems to be so great that sleep fails even when all evident afferent stimuli, such as those mentioned above, are absent, but we know that as long as life exists the central nervous system is constantly plied with subconscious messages and hence it is hard to say if sleeplessness ever results purely from hypersensitiveness of the nervous centres.

Diagnosis.—When asked to treat a case of insomnia, it is necessary for us to endeavour to estimate the severity of the symptom and also to find out the cause of the condition. It is often hard to gauge exactly how badly persons sleep. It is well to ask first of all what is their usual custom in this regard, and how far the present state differs from their normal. If there happens to be a striking clock in the house it is often useful to enquire how many hours the patient heard it strike. He may frequently be surprised and pleased to find how few of the hours he hears strike. It has been well said that people sometimes *dream* that they have not slept! Severe insomnia generally causes a loss of weight. The appearance of the patient's eyes is often an index of the degree of want of sleep.

Environment.—The patient should be placed in the best surroundings possible so as to avoid such evident deterrents

as light, noise, heat and cold. Many persons get into the best condition for sleep by reading in bed, and, if their posture be comfortable and the light good and well placed and easily turned out, there is nothing but good to be said of the custom. The reading matter, of course, must not be of an exciting nature, and anything of the character of work should be absolutely avoided.

Frequently some trifling thing is to blame and idiosyncrasy is frequently evident here. Cold feet are often a source of sleeplessness. Woollen bed socks are of value here as most soldiers who have been on active service will endorse. A hot footbath before retiring is useful, and vigorous people may find that if they dip their feet in cold water and follow this by brisk friction with a rough towel they will get a good reaction. One person will sleep better in a noise than when all is quiet. I know a man who, when he gets off his sleep, will travel to New York and back on the night train and will thus secure two good nights. Whitla mentions two cases of the same kind:—a woman, who suffered from intractable insomnia which had resisted all hypnotics and absolute quiet, yielded to the music caused by the loud hammering in her husband's blacksmith forge beneath her window. Another hospital patient could not sleep until she got a noisy clock from home and had it placed under her pillow. Monotonous noise is often very hypnotic, and at sea most people will waken if the engines stop and quiet ensues. Pleasant monotonous sound, as music, acts in this way. Every mother has found this with her infant and it has been greatly elaborated in certain quarters.

It is well to tell the patient not to *try* to sleep, for such trying only leads to wakefulness. Many people worry too much over a little loss of sleep (as others do over a slight degree of constipation) and they should be told that it will do them no harm and that they are physically resting even though awake.

Diet.—As a rule, heavy and stimulating meals taken late in the evening tend to wakefulness and disturbing dreams. Tea and coffee ought not to be taken in the evening by bad sleepers. Some students well know the effect of these caffeine-

containing beverages in keeping them awake when they mistakenly burn the midnight oil. Often a light meal the last thing at night and notably a hot drink are helpful in promoting sleep. This applies especially to old, gouty, dyspeptic and arteriosclerotic people.

Many people add alcohol to the drink, as a "night cap." As a rule this is not necessary, but sometimes in old persons it is of value and should not then be discouraged.

Specific Treatment.—In every case of insomnia the cause should be searched for and if possible removed. Thus, acidity is a common source, especially in elderly arterio-sclerotic persons, and a hot drink containing 30 grains of bicarbonate of soda at bedtime is often a valuable aid to sleep. Likewise, constipation and flatulence may be underlying causes and the correction of them may remove the insomnia.

Symptomatic Treatment.—Often by the removal of the cause the condition is relieved, but frequently this specific treatment is not possible, or, even when it has been done, the insomnia will for a time remain as a bad habit and may require treatment.

In the symptomatic treatment of insomnia drugs should be avoided as far as possible and only used after simpler measures have been tried and failed. This is specially the case in chronic insomnia, and there is less objection to the early use of hypnotics when the condition is of short duration and due to some definite cause.

A complete warm bath at night may be of service, or a wet pack, in which the patient is enveloped in a wet sheet for about half an hour and then rubbed vigorously with a rough towel. The water may be warm, tepid or cool. This wet pack has a most sedative effect and is much used in asylums.

Occasionally gentle massage at bedtime will cause sleep, and the same thing may be said of electricity, especially the static current.

A patient may be put to sleep by hypnotism, but this is seldom a practical measure.

Hypnotics.—An aphorism attributed to the late S. J. Gee of London was that the great danger of sleeplessness is from

the drugs used to relieve it. But often, when everything else has failed, drugs are temporarily required.

When it is necessary to use such, the milder hypnotics should first be tried and only the more powerful (and especially the habit-forming ones) when they cannot be avoided.

The Bromides are usually tried first. They may be given regularly after meals, but best as a single large dose of 30-60 grs. at bedtime. Any of them may be given, and often a mixture of several seems to act better than the same quantity of one. They merely dull the receptive cells of the brain and thus lessen the effect of afferent impulses. They are of no value in pain.

Sulphonal and Trional are *sulphones*. They are slowly absorbed and slowly got rid of and hence tend to cause drowsiness during the next day, and even have some action on the following night. Their effect seems limited to the brain and there is none on the circulation. Sulphonal is apt to irritate the kidneys and if the urine be the least pinkish the drug should be stopped. In any case it should not be given continuously as a habit is apt to be formed. The pinkish colour of the urine is due to haematoporphyrinuria, caused by an iron-free compound formed by the destruction of haemoglobin. When sulphones have been taken for some time poisoning is apt to be ushered in suddenly with lassitude, nausea and vomiting, and the change in the urine noted. But these symptoms have all been produced by a single dose of 60 grs. of sulphonal.

Fifteen grs. is an ordinary dose of either sulphonal or trional, but twice this amount may occasionally be given. As they are slow in acting they should be taken several hours before bedtime. Trional is prompter in action and less toxic than sulphonal and is now the one generally preferred.

Chloralamide, now official as *Chloral Formamidum*, is an exceedingly safe and efficient hypnotic, and has little tendency to habit-formation and no depressing effects. It acts in about an hour if given in solution, but is otherwise slow: 25 grs. is an ordinary dose and the unpleasant taste may be well covered by liquorice.

Paraldehyde is an excellent, non-depressing hypnotic. It would no doubt be more used than it is, if it were not for its disagreeable taste and smell. It belongs to the chloral group. The B.P. dose is 1/2-2 drs. It may be given in capsules or in a mixture, such as the following:—

℞ Paraldehydi	5jss
Glycerini	5ss
Spirit. Rect.	5ij
Aq. Cinnamomi	ad 5j
M.	

Sig.—A draught, to be taken at bed time.

Often half this dose, repeated in an hour, is better than a single one. Paraldehyde is of special value in delirious toxic states and here the taste is blunted and the patient takes the plain drug easily. If he cannot swallow, it can be given by the bowel in two drachm doses diluted with starch.

Veronal (*Barbitonum*) belongs to the group of *urethanes*. It is a prompt and useful hypnotic and in doses not exceeding ten grains is quite safe. An average dose is 7½ grs. It is very insoluble, but Veronal-Sodium is readily soluble, and may be given in watery solution in an average dose of ten grains. The effect of veronal is increased by adding a small dose of aspirin: a useful combination is five grs. of each.

Chloral Hydrate is a valuable, but edged, tool. It is the most powerful hypnotic we have in nervous insomnia. Being rapidly absorbed and quickly got rid of, it is best to give it in small repeated doses, rather than a single large one. It produces a natural-like sleep, with contracted pupils. In larger doses it causes profound sleep, from which it is hard or impossible to rouse the patient. There is also much depression of temperature and at last it weakens the heart muscle and vaso-motor centre, and finally paralysis of the respiratory centre occurs and is the usual cause of death. The effect upon the heart has perhaps been over-estimated, and in medicinal doses, does not exist and need not be feared. Chloral depresses the motor centres in the cord, and is much used for this reason in relieving spasm anywhere and the convulsions in tetanus and epilepsy. It is useless in the relief of pain unless this be

due to muscular spasm: then it is valuable, and was much used by obstetricians to ease useless labour pains, but morphia or hyoscine have now largely replaced it for this purpose. The B.P. dose is 5-20 grs. Thirty grains is said to have produced death, and the safest way to use the drug is to give it, as said, in small doses (say 10 grains) and repeat in two hours if required. The B.P. syrup is an elegant preparation: it contains ten grains of chloral hydrate in each drachm.

Where severe pain prevents sleep, opium is by far the most potent drug at our command, but, unless for this purpose, it is not one that should be used in insomnia except where the sleeplessness is due to some passing cause.

Often a combination of several hypnotics is better than a large dose of one.

In acute maniacal condition, Hyoscine Hydrobromide, in doses of 1/200-1/100 gr. hyperdermically, is often of great value and may quiet the patient and produce sleep when every thing else fails. It may also be given by the mouth, but is then less certain in its action. It is a drug for emergencies, and not for the ordinary treatment of insomnia.

An enormous number of drugs exist, some of which may occasionally be of greater value than those mentioned, but if the practitioner be armed with the above he will be ready to care for most cases of sleeplessness, especially when he remembers that everything else should be tried first and drugs only resorted to when other remedies fail.

CHAPTER XXVIII.

DISORDERS OF THE NERVOUS SYSTEM.

PAIN. HEADACHE. NEURALGIA.

PAIN.

The relief of pain is one of the most important functions of the physician. Pain is only a symptom, a subjective phenomenon, and hence we are very largely dependent upon the patient's statement of how bad it really is. In severe cases, the practitioner may be able to judge somewhat of the degree of suffering by such signs as a rise in blood-pressure, loss of weight, etc., and in chronic cases the effects may be shown in many ways, but as a rule we must largely rely upon the patient himself as to the degree of his disability.

In order that pain may be felt, two factors must be present: (1) the appreciation of pain afferent-impulses, and (2) the afferent impulses themselves. The first factor varies enormously, and painful sensations that will completely incapacitate one person will scarcely disturb another. At the one end of the scale there are people who have a complete absence of pain sensation even when they are otherwise conscious. Such a case appeared in the person of a soldier who apparently could not feel pain at all. His arms showed numerous scars where his friends had burned him with cigarette ends in order to test his statements. This man was undoubtedly hysterical, but an absence of pain sensation also occurs in certain organic diseases, e.g. syringomyelia.

At the other end of the scale are those persons who cannot bear the least operation, such as a hypodermic injection, without suffering acutely. Cabot points out that such people usually have over-active knee jerks, and I think this is the case and that the activity of the patellar reflexes and the sensitiveness to afferent pain impulses often go together.

It is evident then that the appreciation of painful sensations varies greatly, and in judging of the significance of pain

as a symptom of disease it must be remembered that a very little complaint in one individual may mean more than a very great one in another.

The pain centre lies in the posterior central convolution and pain is really appreciated there. If this centre be dulled then afferent impulses may arrive to any extent and yet are not felt. Such a state exists in hysteria sometimes where the sensation of pain is absent, and it is probable that many of the martyrs at the stake felt no pain, such was their ecstatic condition. The centre may be dulled by drugs so that pain is less felt, and among these drugs opium and its derivatives easily stand first. Opium does not affect the nerve-endings nor yet the nerve conduction and when it relieves, say, the pain of renal colic, the same number of afferent impulses are arriving at the centre as before but are not now so much felt and hence the patient gets relief.

It takes a martyr to bear some pains but the lesser ones may frequently be made still less if the sufferer will try to ignore them, and here the physician can often help him. Frequently he can see that the pain does not mean any serious disease and if this be explained to the patient much good will follow. The chief suffering in connection with many pains is the dread that they mean some serious condition. For instance, a little intercostal neuralgia is misinterpreted by the patient as meaning heart disease or pleurisy, and if the doctor will explain that this dread is unfounded, the pain may require little further treatment. It will have lost its significance and may soon sink from the arena of consciousness.

The cause of the pain must be sought for and if possible removed. Thus, a carious tooth can be treated; a hyperacidity irritating a gastric ulcer may be neutralized; the pressure upon some nerve removed, and so on.

Often the nerve-endings may be soothed by heat or numbed by cold or by local anodynes, such as cocaine, orthoform or menthol, but in most cases we relieve pain symptomatically by the action of drugs upon the pain centre. Many drugs act in this way, such as the tar products, and have been referred to under different headings, but the one that stands out beyond all others here, is opium, and it requires special attention.

OPIUM is the dried juice from the unripe heads of the white poppy. Turkey opium is the kind used in Medicine, as the Indian and Persian varieties contain much less morphia and more narcotine, which is not of so much value. Good Turkey opium contains about 20 per cent. of alkaloids, half of which must be morphia. Some samples hold as much as 18% of this and have to be diluted before being used for the making of the various B. P. preparations. The other important alkaloids are papaverine, codeine, narcotine, thebaine and laudanine.

The chief effects of opium are due to the morphia in it. This alkaloid has a specific effect upon the central nervous system, especially upon the sensory cells. In animals it is found that the action of morphia upon the brain is in proportion to the development of the cerebral hemispheres. Thus, in the frog, where these hemispheres are mere protuberances from the third ventricle, an enormous dose is required to produce much effect. When this is given, the animal becomes dull and the functions of the brain are depressed in the reverse order to their development, then the medulla is affected and the respiratory centre depressed, and at last the spinal reflexes disappear. After a time, these reflexes enter a stage of excitability and strychnine-like spasms occur and even convulsions. In mammals a set of symptoms are produced which can be best explained in the same way on the assumption that the drug depresses the various cerebral centres in the reverse order to their development. There is usually a short period of excitement, which may, as in the case of alcohol, be explained by the depression of the higher centres so that the lower ones are less controlled. Some drowsiness next ensues and sleep occurs, usually accompanied by vivid dreams, generally of a pleasant nature. All sensation, and especially that of pain, is lessened. In most mammals the depression of the higher centres is the most evident thing, but in some, as in the cat, the excitation of the cord (whatever be the exact reason) is well developed, and in rare instances in man this also occurs. Thus a patient is recalled in whom an injection of morphia always caused strychnine-like symptoms. As a rule, the re-

flexes are lessened and hence morphia is useful in lessening cough, spasms and even convulsions.

The drug is found experimentally to have no action upon nerve-endings and the local use of it should have no more effect than when it is given at a distance. But there is much clinical evidence that there is some local action and in painful conditions of the rectum a morphia suppository or an enema of opium has probably more analgesic effect than a hypodermic injection into the arm. It slightly depresses most of the secretions such as those of the stomach and alimentary canal, but has no effect upon the secretion of urine and rather increases the action of the sweat glands. It has little or no action upon the heart or blood vessels except that it slightly dilates the latter through central action and thus gives a sensation of warmth over the surface of the body.

The general effect upon the alimentary tract is a decrease of peristalsis, although in some animals there may be a temporary increase in this with the production of vomiting and purging. This is rarely seen in man.

Along with the general depression metabolism is lowered and sugar may appear in the urine. And yet opium has a controlling influence upon this in diabetes.

All the opium alkaloids produce nervous depression which tends to be succeeded by a strychnine-like effect upon the cord, the cause of which is not yet clear. The different alkaloids differ in this tendency, some having the depressing action more than the stimulating one while others are the reverse. Morphia is the most depressing and laudanine the most convulsant, and the alkaloids are arranged by Dixon in the following order:

Morphia (most narcotic and least convulsant),
Papaverine,
Codeine,
Narcotine,
Thebaine,
Laudanine (most convulsant and least narcotic).

Morphia is the most narcotic and analgesic, and increased reflexes and twitchings are rarely seen after it, although they

may exceptionally occur. Codeine is not so narcotic and is followed occasionally by restlessness and increased reflexes. It is less depressing than morphia on the respiratory centre, and is much used for the relief of cough. It is not of much value in the easing of pain and should never take the place of morphia for this purpose.

There are a large number of pharmacopoeial preparations that contain opium or morphia, of which the ones most commonly in use are the following:—

Opium. Dose $\frac{1}{2}$ -2 grs.

Extractum Opii Siccum, which is twice as strong as opium, being standardized to contain 20% of morphia. Dose $\frac{1}{4}$ -1 gr.

Pulvis Ipecacuanhae Compositus, which contains 10% of opium. Dose 5-15 grs. It also contains an equal amount of ipecacuanha.

Tinctura Opii (Laudanum), which contains 1% of anhydrous morphia. Dose 5-15 mins. for repeated administration and 20-30 mins. for a single dose.

Tinctura Opii Ammonmiata (Scotch Paregoric). Contains 1% of opium along with benzoic acid, ammonia and aniseed. Dose $\frac{1}{2}$ -1 dr.

Tinctura Camphorae Composita (Paregoric). Contains about 2 grains of opium in the ounce and also camphor, benzoic acid and aniseed. Dose 30-60 mins.

Pilula Saponis Composita, which contains 1 part of opium in 5. Dose 2-4 grs.

Pilula Plumbi cum Opio. Has opium to the extent of 1 in $8\frac{1}{2}$, along with acetate of lead. Dose 2-4 grains.

Morphina. The dose of this is $\frac{1}{8}$ - $\frac{1}{2}$ gr. but it is seldom used as the pure alkaloid but as the acetate, hydrochloride or tartrate, all of which are official and have the same dose as the alkaloid itself. The larger dose is seldom given hypodermically.

Suppositoria Morphinae. Each contains rather less than $\frac{1}{4}$ gr. of morphia.

Tinctura Chloroformi et Morphinae Composita. Contains 1% of morphia along with chloroform, dilute hydrocyanic acid, Indian hemp and capsicum. Dose 5-15 mins.

There are a number of unofficial preparations of opium that are in common use. The only one that will be mentioned here is Omnopon (Pantopon) which is said to contain all the alkaloids of opium as the soluble hydrochlorides. It is an excellent preparation and produces the good effects of opium with less of its undesirable after-effects. A 2% solution of it can be given either hypodermically or by the mouth, and it is also used in solid form.

Omnopon is five times as strong as opium and the dose is proportionately smaller.

It is a common practice to give atropine along with morphia, with the idea of lessening its depressing effects upon the respiratory centre, but this is not necessary as a routine practice and atropine produces some objectionable features, such as dryness of the mouth, which it is well to avoid.

The use of opium is always attended by the risk of habit-formation and it is well for the practitioner to mark a prescription containing it *Ne repetatur*. Opium is badly borne by infants and hence the dose should be very small here. It should also be very cautiously used in cases of nephritis, alcoholic intoxication and in embarrassment of the respiration. In the last-named condition it is well to combine atropine with it. In inoperable malignant disease and also in all incurable and quickly fatal diseases where there is much pain and distress, opium should be freely used, and here omnopon is specially valuable as it disturbs the digestion so little.

It is sometimes useful not to let the patient know that he is taking opium and in this case one of the preparations in which the name of the drug does not appear may be used, such as the compound soap pill.

HEADACHE.

Pain in the head may be due to the most diverse causes, and before any efficient treatment can be undertaken every endeavour must be made to ascertain the source of the trouble.

The exact seat of the pain in headache is largely a matter of conjecture. It is certain that the brain substance is quite insensitive, as is also the bony brain-case, but the meninges are freely supplied with sensory nerves, as are probably also

the blood vessels, and as both membranes and blood vessels dip deeply into the brain it is easy to see how various deep brain diseases may give rise to pain. One theory of headache is that it is due to an increase in the pressure of the cerebro-spinal fluid. This is probably often the case and of course any of the nerves in the cranial cavity may thus be stretched or pressed upon.

In the same way, although the bony skull-box is insensitive, it is covered by membrane which is freely supplied with sensory nerves, and so a bony lesion may cause pain and headache.

Headaches have been variously classified and the following is a grouping (founded upon the probable source of the pain), which may be found convenient.

Classification of the Causes of Headache.

A. Organic—

- (1) Intracranial disease, such as tumours, abscess, meningitis.
- (2) Cranial, pericranial and diseases of structures superficial to these.

B. Functional—

- (1) Reflex and referred from nose, eyes, teeth, digestive tract and other distant parts.
- (2) Toxaemic: (a) autogenetic; (b) heterogenetic.
- (3) Hyperaemic: (a) active; (b) passive.
- (4) Anaemic: (a) general; (b) local.
- (5) Nervous: Neurasthenia or Hysteria.
- (6) Migraine.

Diagnosis.—Intracranial organic disease will usually show itself by the existence of some signs such as paralysis, rigidity of the neck muscles, alteration in the reflexes, Kernig's sign, variations in the composition or pressure of the cerebro-spinal fluid, optic neuritis, etc. When the trouble is situated in the bone or is superficial to it, the symptoms and signs are likely to be local and there is usually localized tenderness and perhaps alteration in the contour of the affected part.

As regards reflex or referred headaches, most of us have seen such that were due to some abnormality in the sinuses

connected with the nose, and, if unrecognized, have at last been relieved by the free discharge of pent-up pus from the nose. In the same way, the trouble may arise in the eyes from some organic disease, such as glaucoma or from errors of refraction, and it is well to remember that it is the slight errors that are the most apt to be the offenders here.

It has long been recognized that tooth conditions can cause headache as well as local pain and lately the X-ray has revealed the frequency of quiescent *foci* of infection at the roots of the teeth and these may cause the trouble, either by causing referred pain or by producing toxæmia. All the same, in the writer's opinion, this source of trouble has of late been rather over-emphasized, as investigation shows that few people above the age of fifty are free from such, and yet in how few are any symptoms produced! Disturbances in the stomach and intestines are one of the commonest sources of headache. Such should probably be classed as a rule as toxæmic, although some of them are believed by Head and others to be reflex. This class is usually very amenable to treatment.

Toxæmic headaches are very common. The poison may be introduced from without as in the case of alcohol or lead or may be autogenetic, as in gout, uræmia and many alimentary disorders. Most fevers are accompanied by headache, and this is probably usually toxæmic, although there is always the possibility of actual infection of the intracranial structures.

Headache is seen in full-blooded individuals with high blood-pressure and general congestive tendencies. These are probably largely toxæmic, but are also congestive. If the symptoms are severe and long-continued, a venesection may give more relief than any drug therapy, and Nature often brings this about by a timely nose-bleed.

Anaemia is sometimes a cause of headache, although I agree with Cabot that this is not common. Many of the worst headaches, according to Pal, are due to localized anaemia from spasm of the cerebral vessels. The same may even go on to local paralysis.

In neurasthenia, headache is nearly always present. It is often occipital and tends to be accentuated by any emotional

disturbance. The question here is whether or not the patient is suffering from an increased sensitiveness of the pain centres, so that afferent impulses which usually are unfelt now come within the range of consciousness and are interpreted as pain. The same class of people very constantly have pain or discomfort in the epigastrium.

In hysteria we often see a peculiar form of localized headache, where the complaint is of a stabbing sensation, often accompanied by great tenderness at the same spot, which is usually at the vertex. Nervous people have various sensations about the head besides pain, such as a feeling of bursting, of tightness, of formication, and so on. All these are probably due to the enlargement of the field of consciousness and must be treated by general rather than by local means.

Migraine is a very special form of headache, which often occurs in keen strong people of a nervous temperament. It frequently runs in families. The three stages, of visual disturbance, headache and finally vomiting, are characteristic, but one occasionally sees one or even two of the stages missing, and then the diagnosis is not so clear. Some cases of paroxysmal vomiting are probably examples of the third stage occurring alone.

Environment.—When a person has a headache, the quieter he is kept the better, and often certain drugs will only be of service if he will keep quiet mentally and physically during their action. It seldom pays to try and fight a headache unless it be very slight. The room should be darkened, as light is usually trying to these sufferers. In the more chronic forms of the condition the patient should be spared from all worry as far as possible.

Diet.—During a severe headache, food should not be taken as the digestion is usually for the time-being in complete abeyance and the food will not be digested. The free imbibition of water is often, however, of value and if it should happen to be vomited this will do good rather than harm.

Specific Treatment.—When one thinks of the many totally different causes to which headache may be due, it is evident how important it is for the physician to go thoroughly into the etiology before attempting to treat the case. Often some

underlying cause may be unearthed which is quite removable and thus the case may be specifically treated. Frequently several causes are at work and yet if we succeed in removing one, the pain may be relieved. This is seen when a neurasthenic is eased of headache by the correction of an error in refraction.

Symptomatic Treatment.—Sometimes it is impossible to find or to remove the underlying cause of headache, or the specific treatment may take time, and in the meantime certain drugs and other remedies may symptomatically relieve the condition.

Cold applications to the head, such as an ice-bag or an evaporating lotion are useful. Occasionally heat is more effectual. Counter-irritation to the back of the head, in the form of a blister or a mustard leaf, is often of value. When headache is due to some unremovable cause, sometimes it may be much relieved by the introduction of a Seton into the back of the neck. Here the skin is transfixcd by a scalpel and into the wound is inserted some 9 inches of household tape, half an inch wide. The free ends are tied together and the seton is moved a little every day and may be worn for a period of three months. I recall a case where we diagnosed a cerebellar tumour, the chief symptom of which was persistent and very intense headache. Trephining was done and a tuberculous mass seen and left alone, as irremovable, and the wound was closed. The headache persisted as before. A few days later a stitch abscess formed and when it discharged, the headache was relieved and continued absent. The patient completely recovered. Here it seemed that the stitch abscess acted as a seton.

Occasionally electricity will relieve a persistent headache. A weak continuous current is passed through the head, using 3 or 4 Leclanché cells with one moistened pole over the occiput and the other over the forehead. Often, as mentioned, in high blood-pressure with toxæmic headache, the free letting of blood will do more good than anything else.

As regards the use of drugs, in the first place, the bowels should be kept open, and often a mercurial purge is the best, at least at first.

The chief reliever of pain is opium, but this is less used in headache than in any other form of pain, but may be of value when the headache is of organic origin as from a tumour. In cerebral congestion opium sometimes increases the excitement and is seldom indicated. In slight headache 5-10 grains of aspirin is often useful. Certain of the coal-tar derivatives have a very decided action in relieving pain, which is not of inflammatory origin. The three most commonly used are phenazone, phenacetin and acetanilide. These all act in much the same way. The safest is phenacetin and the most toxic acetanilide. The doses are, phenacetin 5-10 grs., phenazone (antipyrene) 5-10 grs., and acetanilide (antifebrin) 2-5 grs. When given in too large doses or for too long a time these drugs all tend to change the oxyhaemoglobin of the blood into methaemoglobin and thus cause cyanosis. They have little effect upon the normal heart. In migraine phenazone is specially useful, given in a 10 grain dose followed by half that amount in half an hour if required. Luminal in doses of $\frac{1}{2}$ -1 grain t.i.d. will often prevent the onset of sick headache. Caffeine often relieves a headache and frequently it is combined with one of the above. A great many other drugs are used for the relief of headache. Many proprietary preparations also exist, most of which depend for their action upon one of the tar-bodies, and hence should be used by the laity with caution, if at all.

In persistent headache from any cause, but especially when of organic origin, spinal puncture will give great relief. It seems to act by reducing pressure.

NEURALGIA.

Pain in the nerves may be due to some tissue change there, such as neuritis, but the term neuralgia is usually meant to refer only to those cases where no such lesion exists, and the nerve is either merely irritated or poisoned by some toxin, or is not, itself, the seat of any abnormality at all, but the pain is referred to it from elsewhere. Thus, in a carious tooth, pain may be felt in the course of the auriculo-temporal nerve and yet this nerve is normal and our treatment is directed to-

wards the faulty tooth. Often it is hard to find any such local or distant organic cause, and the pain that then occurs is usually termed idiopathic neuralgia.

Idiopathic neuralgia may depend upon some general condition such as neurasthenia, or some general toxæmia or ill-health as gout, uraemia, diabetes or lead poisoning. Attacks of neuralgia are often periodic, but only a few of these depend upon malaria. The condition may occur in any sensory nerve but the most common sites are the trigeminal nerve, the lumbar and intercostal nerves and the coccygeal plexus. Neuralgia about the shoulders is also common.

Diagnosis.—Neuralgia is only a symptom and when pain occurs in the distribution of any nerve, we must endeavour to exclude neuritis and other organic causes. Then, when we conclude that the case is one of neuralgia, it is necessary, if possible, to find the cause. Is it pain referred from some area of irritation such as a carious tooth, a diseased antrum, inflammation in the ear, etc.? If not referred, is it toxic, and so on?

Environment.—Neuralgic patients are very susceptible to cold, and frequently an attack may be precipitated or made worse by exposure to a draught of cold damp air. Also, such people are very susceptible to climatic changes apart from mere temperature, and they can often foretell a change in weather with much certainty. A moderately warm, equable, climate suits them best, and in bad and persistent cases, it may be necessary to advise such, when it is possible. Worry and depressing nervous surroundings are bad for these cases.

How often the physician sees some domestic worry, such as trouble with domestic servants, precipitate an attack!

Diet.—It has been said that "neuralgia is the cry of the nerves for better or purer blood," and states of ill-nourishment are very apt to be complicated by it, and the trouble can then be best got rid of by a generous diet.

In anaemic, underfed people, cod-liver oil and iron, which may both be looked on here rather as foods than as drugs, are more effectual than all so-called anti-neuralgic medicines.

In some people, however, who are of a gouty diathesis, the diet, and especially the purin-containing foods, should be limited.

Specific Treatment.—Very often we can remove the cause of the trouble and so make an end of it. No case should be treated symptomatically until this has been done as far as possible.

Symptomatic Treatment.—In only too many instances we cannot find or easily remove the cause, or, even when the cause has been treated, the pain may for long remain, and in all those cases symptomatic treatment is required for the relief of the suffering.

Locally, the mere protection of the painful area, with some cotton wool and a bandage or with flannel, against changes of external temperature, is often useful, and no doubt the various porous plasters act largely in this protective way.

Heat in any form is useful but, exceptionally, cold gives more relief. Dry-cupping over the seat of the pain is often of great value, or we may employ counter-irritation, as with a fly-blister or by the use of mustard. Local anodyne drugs may give relief. Such are menthol, chloral-camphor and belladonna. Opium or morphia applied to the unbroken skin are not absorbed and hence are useless here.

Electricity is much employed in persistent neuralgia. Usually the best results are obtained from a galvanic current of low tension, such as that produced by 3 or 4 Leclanché cells. The negative pole should be placed over an indifferent part of the body and the positive one over the painful nerve. 3-8 milliampères can be permitted to pass for 10 to 15 minutes once daily. The labile method may be employed in chronic cases, the anode being slowly moved along the course of the nerve without breaking contact. There are many special methods of using electricity here but space does not permit of their discussion.

Arsenic or phosphorus will sometimes relieve a chronic neuralgia and should be given for weeks in small doses. Both these drugs, in some obscure way, seem to improve the nutrition of the nerves.

Opium and morphia will give rapid relief more surely than will any other drug, but must be used with great caution and only after other remedies have failed, as the habit is so apt to be formed. Many a morphomaniac dates his downfall from

an attack of neuralgia. When morphia must be used, many physicians believe that it acts better when injected locally in the painful area than when given at a distance.

Cocaine, injected locally, is also very efficacious but is even more apt to form the habit than the use of morphia.

The tar derivatives, such as phenazone, phenacetin, and acetanilide, are the drugs of choice and usually are sufficient. Aspirin, also, has some action here and may well be combined with one of these.

Gelsemium and Butyl-Chloral hydrate are believed to have a selective action upon the fifth nerve and are often given in neuralgia here. A pill, such as the following, may be used:—

R	Extract. Gelsemii Alcoholici	gr. ss.
	Extract. Cannabis Indicae	gr. 1/6.
	Butyl-Chloral Hydrat.	gr. iv.
	Ft pil. secund. artem.	

Sig.—One every four hours.

In periodic neuralgia, even though not of malarial origin, quinine often does good and may be given in five grain doses t.i.d.

Potassium iodide sometimes is of service in chronic neuralgia, even when there is no syphilitic taint. 5-10 grs. t.i.d. is the usual dose here.

Special mention must be made of Trigeminal Neuralgia (Tic Doloureux), which in its fully-developed form gives rise to agonizing suffering and may require radical treatment for its relief. In the slighter forms of neuralgia of the fifth nerve the therapy already discussed can be tried and is usually successful, but, if the pain persist and from its severity is wearing the patient out, then something more may be necessary.

The injection of alcohol into the trunk of the affected nerve often gives relief which may last for a year or more and occasionally is even curative. The details of the little operation may be found in any reference book. The chief difficulty is in striking the nerve, but when this is done it is very successful.

If this be insufficient, it may be necessary to divide the branch of the nerve affected, but the effect of this is usually only temporary.

The excision of the whole or of part of the Gasserian ganglion has now been done very many times and is the most effectual, though the most serious, way of treating the condition. If the ophthalmic division of the ganglion be left intact, all eye complications are avoided.

CHAPTER XXIX.

DISEASES OF THE NERVOUS SYSTEM.

CHOREA. EPILEPSY.

CHOREA.

Chorea is a condition in which more or less wild, involuntary, movements occur, with often much psychical disturbance and a great tendency to the occurrence of endocarditis. It is very common in children, but adults may be affected by it, especially pregnant women.

The condition is closely associated with the infection of rheumatic fever, and the two diseases frequently exist together, although either may occur alone. Nervous shock, such as a fright, may seem to precipitate an attack, but that this is not a common cause, in adults at least, is shown by the fact that it was rare among soldiers on active service, in spite of the frequent shocks to which they were subjected. It is not uncommon in pregnancy and is then probably toxic in origin.

There are all degrees of chorea, from such slight ones as to be scarcely noticeable to those in which a delirium of movement exists, which may be accompanied by wild mania and can cause death from exhaustion.

Diagnosis.—The slight cases are easily missed and a child may be accused of clumsiness and carelessness in dropping things. In the severer forms the diagnosis is only too evident. As already said, the underlying cause (or at least associated condition) is in most cases the rheumatic infection, but even where the rheumatic element is not evident endocarditis may occur, so the heart should be very frequently examined with this in view.

Environment.—The choreic patient should be isolated, and kept very quiet: probably this is the most important part of the treatment. In hospital practice, if a single room cannot be obtained the patient should at least be placed in a quiet

corner of the ward and be surrounded by screens. All visitors should be prohibited, as they tend to excite the sufferer. Often the presence of other children is worrying, as these are apt to tease and mimic the patient. If such be the case the patient should be kept among adults, and a change to the quiet surroundings of the country is often desirable to complete the cure. In bad cases, skilled nursing is very necessary, and a sympathetic nurse can do much to control the mental and bodily excitement without the use of any forcible restraint, which should always be avoided. Often it will be necessary to use side-boards for the bed, and these ought to be thickly padded to prevent bruising.

Diet.—In the acute condition the patient may have great difficulty in swallowing, but a skilled attendant can usually feed her sufficiently by using patience. Fluid diet of a non-stimulating character is best at first.

Specific Treatment.—In all cases that appear to be associated with rheumatic fever, the specific treatment for this should be pushed, and maintained as long as any suggestion of infection remains. All sources of local infection, such as diseased tonsils, etc., or of reflex irritation should be searched for and if possible removed. Auto-serum therapy may be tried, and has met with considerable success, although it cannot yet be called a routine method of treatment here. 50 c.c. of blood are withdrawn from the arm of the patient and 20 c.c. of the serum from this is injected intrathecally. The average number of injections is three, done at intervals of several days.

Arsenic appears to have some power of controlling the condition, and is the drug most commonly employed in the cases that are not distinctly rheumatic, and in these cases also after the rheumatic infection appears to be controlled. The usual method is to begin with perhaps five minims of the *liquor arsenicalis* thrice daily and to gradually increase the dose until 10 minims has been reached or some physiological effects occur, such as nausea and vomiting, diarrhoea, puffiness about the eyes, and especially any signs of neuritis (the knee-jerks should be frequently tested when a patient is taking arsenic

freely, and any lessening of them demands a cessation of the treatment). Children bear arsenic very well and choreic cases seem to stand it even better than others. After the drug has been omitted for a few days the course may be repeated if necessary.

Another method is to give the drug in large doses from the first. Occasionally the stomach resents arsenic and it may then be given hypodermically, or intramuscularly, in the form of cacodylate of soda, an average dose of which would be half a grain once daily for a child of ten.

It is fair to say that some physicians do not believe that arsenic has any curative effect in chorea.

Symptomatic Treatment.—Warm baths have a very soothing influence here, and should be frequently used and, especially at night, may promote sleep. In very severe cases, the continuous warm bath, in which the patient is kept for hours or even days, may be necessary.

Various nerve sedatives are frequently used in chorea, especially the bromides, chloral hydrate, phenazone and chloretone. They are all useful in controlling the violence of the movements; often a combination of them is useful.

Anaemia is very frequent here and should be treated with iron. Lumbar puncture, done under an anaesthetic, sometimes eases the violence of the muscular movements.

If the heart be affected it will require special treatment, as described under that heading.

In greatly protracted cases the possibility of congenital syphilis should be borne in mind.

The average case lasts from four to eight weeks, after which the patient gradually improves, but for long will require close watching, as relapse is not rare. School-work should be prohibited for several months after an attack, but the patient may do a little home-work with advantage.

Practice in co-ordination is of value during convalescence and the patient by this gradually learns to control her movements. At first the exercises should be simple, such as slow flexing and extending of the limbs, best against resistance; then the use of children's building blocks, or dominoes, is of

value, and with older patients needle-work and playing the piano are of service. Slow systematic breathing exercises are often important.

EPILEPSY.

Epilepsy may occur as a localized condition (Jacksonian or Cortical Epilepsy); as giddiness, slight lapses of consciousness or sudden jerking of the limbs, sudden tremor or sudden visual sensations, all of which are termed *Petit Mal*; or as general convulsions with loss of consciousness (*Grand Mal*). When attacks of *grand mal* succeed each other in rapid succession without the patient recovering consciousness the *Status Epilepticus* is said to exist. This is a serious condition and is not infrequently fatal.

The chances of an individual taking fits depends upon two factors: first, the degree of irritability of the central nervous system, and, second, the amount of irritation applied or conveyed to it. If the nervous centres are very hypersensitive very little irritation may cause a nerve-storm in them, which is epilepsy; while, on the other hand, when these centres are of normal stability they will stand a great deal of irritation before an explosion ensues.

The hypersensitiveness of the nerve-centres may be inherited or be due to toxæmia or to circulatory disturbances. The irritation may be central as in the case of a brain tumour or a depressed fracture of the skull, but is very frequently of the nature of afferent impulses coming from distant parts of the body, especially the alimentary canal. Thus, in a nervous child, an indigestible meal or the presence of a round worm in the bowel may be sufficient to cause convulsions. Some writers believe that epilepsy is a psychosis, and has its origin in some suppressed fear which may be revealed by psychoanalysis. It is hard to believe that this is a common source of the trouble.

In Jacksonian Epilepsy there is usually some local organic cause in the region of the motor area affected, such as a depressed fracture of the skull, a tumour, or some vascular disease. In *petit* and *grand mal* such an organic cause may be present, but usually the convulsions are due to the first factor,

i.e.,—a hypersensitiveness of the nerve centres, and such cases are termed *idiopathic*.

The storm usually begins in some definite area and rapidly spreads over the brain, involving consciousness more or less completely. The commencing excitement shows itself as an *aura*, then follows the convulsion proper, and this is succeeded by the post-epileptic state in which the patient usually sleeps heavily, but may act in a strange manner for which he is not accountable.

Diagnosis.—The condition must be distinguished from hysteria, in which the patient is not really unconscious and may generally be roused by appropriate treatment, such a cold douche or the faradic brush. He may fall, but takes good care not to hurt himself or to bite the tongue. Involuntary micturition or defecation very seldom occurs in hysteria while they are common in epilepsy. The diagnosis of the case should include the probable cause of the fits, as this is so important from the standpoint of treatment.

Environment.—During a fit, the patient should be placed in such a position that he cannot harm himself; should have plenty of fresh air, and the clothing be loosened about the neck. It is customary to place a cork between the teeth to prevent the tongue being bitten. Any dental plates or pieces of food should be removed from the mouth if possible. After the fit is over the patient must be allowed to quietly sleep off his fatigue, but he should be watched, as sometimes in the post-epileptic state he may suddenly commit some homicidal or suicidal act, for which the attendants and not he may be responsible. The post-epileptic condition is most apt to be dangerous after *petit mal*. It is often plead in Court in defence of some act of violence that this may have been done while the prisoner was in this state.

The surroundings and mode of life of the epileptic are a very important subject. Generally speaking, these should be such that in the event of a fit occurring, he is not himself exposed to danger, nor does he endanger others. Thus, an epileptic should not be an engine driver, chauffeur, or a signal-man on the railway. A country life is to be preferred and many a confirmed epileptic can do good work here, but, as

said, should not be trusted alone where he may endanger himself.

Bad cases can best be treated in Institutions or Colonies for epileptics. Here they are under constant supervision and receive education and training suitable to their condition. But most of the slighter cases do not require to be sent to such places, as long as they have relations or friends who will keep a watchful eye on them. The education of epileptic children requires much care, and the moral training is most important, as their morale is apt to be poor.

Marriage should be discountenanced in epileptics.

Diet.—A plain non-stimulating diet should be enjoined. A large indigestible meal will often induce a fit in one subject to them. Meat and all purin-containing bodies are exciting and should be largely avoided, and the same remark applies to tea and coffee. If the patient is taking bromides these will probably act more efficiently if the sodium chloride intake is limited. Alcohol should always be banned.

Specific Treatment.—A thorough investigation of the case may reveal some removable cause. In most epileptic cases commencing after the age of thirty the cause is syphilis and appropriate specific treatment should then be employed. This may stop the fits long before a negative Wassermann reaction can be obtained.

Where a localized cerebral lesion exists, such as a tumour or a depressed fracture of the skull, operation is required. It is an interesting fact that operations on the skull or even anywhere in the body have a controlling influence over fits, and for a time these may cease, although they commonly return. This should be remembered in judging of the results of such treatment, and it is always well to wait for six months at least, during which time the patient has not been taking bromide, before concluding that the operation has been curative. It is surprising how seldom gunshot wounds of the head are followed by epilepsy. A. Turner¹ found it in only 5 per cent. of 18,000 cases and in some of these there was doubt if the lesion was the cause.

Symptomatic Treatment.—During a convulsion, little, as a

¹*Brit. Med. Journal*, October 7th, 1922, p. 640.

rule, need be done beyond protecting the patient from injury, but if the attack be at all prolonged, especially in children, a warm bath is of value. The patient may be given a few whiffs of chloroform or of nitrite of amyl. The latter is especially useful in *petit mal*.

The Status Epilepticus is a condition in which the patient continues to have fit after fit without recovering consciousness between them. It may be fatal, the patient dying worn-out. Chloroform should be freely used here or a drachm of chloral hydrate may be given *per rectum*. Gowers often gave full doses (1/150-1/50 gr.) of hyoscine hyperdermically for this grave condition.

The prevention of further fits may, to a large extent, be attained by the use of bromides. These so dull the nerve centres that they are less easily excited than usual. Thus, it has been found almost impossible to cause fits in dogs by cortical irritation when the animals are under the influence of bromides, while otherwise it is easy to do so.

It is seldom necessary to give more than one drachm of bromide a day, and if this amount does not stop the fits larger quantities often fail to do so. As already mentioned, bromides act better when the common salt is lessened in the diet. They are easily taken in milk. When they fail to stop the fits their action may sometimes be enhanced by combining with them medicinal doses of nux vomica, digitalis, and especially belladonna which drug by itself is often of great value. It is largely a matter of experiment which of these three may help most in an individual case. The tendency to bromism can be lessened by small doses of arsenic.

Some believe that the prolonged use of bromides may bring about mental depreciation, but epilepsy is so often associated with this in any case that it is always doubtful whether it is due to the disease or to the remedy.

Bromides should be continued in gradually lessening doses for at least two years after the last fit. Perhaps ten per cent. of cases will remain free from fits after they have been discontinued.

When bromides, alone or combined, as above-mentioned, fail, other drugs may be tried and occasionally do better.

Luminal, which is phenyl-ethyl-barbituric acid, or its soluble sodium salt, has been much used in recent years in epilepsy and often proves valuable, especially when the fits are frequent. The usual dose of luminal is 2-5 grs. a day. It does not appear to give rise to a drug habit, but the effect is apt to wear off so that the dose must be increased. It may well be combined with the bromides in a mixture containing mucilage.

Borax, in ten-grain doses thrice daily, is often of use. Antipyrine is of some value and may be used alone in doses of five to ten grains t.i.d., or in smaller amounts combined with the bromides. Opium has been used by some. Thus Flechsigg recommends the giving of this, commencing with $1\frac{1}{2}$ grs. a day and rising to as much as 15 grains of it a day for some days; then stopping it and giving bromide for a time, afterwards returning to the opium. But the danger of the habit is too great to allow of such a practice. Zinc Oxide (5 grs. t.i.d.), silver nitrate ($\frac{1}{8}$ gr. t.i.d.), and many other inorganic drugs have been used, and also very many organic compounds.

If the aura be definite and local, a fit may sometimes be stopped by controlling this. Thus, for example, when the aura consists in the twitching of the muscles of a hand, a tight string round the arm may stop the fit. Counter-irritation, such as blistering, over the site of the aura may be of value, and was much used by Brown-Séquard. The change in the skin must be reflected in the corresponding nerve-centre.

I recall a very severe case of epilepsy in which the aura was always a sensation of cold that commenced in the epigastrium and passed spirally down and round the body, and when it reached the gluteal region, the patient fell unconscious and was frequently bruised or burnt. If she could get a drink of cold water as soon as she felt the aura, the fit did not occur. Similarly, some patients find that by violent breathing, shouting, jumping, or the inhalation of snuff or smelling salts, after the aura has occurred, they can sometimes avert a fit. The aura may only last for a few seconds, but occasionally may be prolonged for a day or two, the patient being conscious all along that a fit is imminent, although long postponed.

When by the use of bromides or other drugs the fits have been controlled the medication should be continued for weeks and only very gradually stopped as it is so important, as Gordon Holmes¹ points out, to "break the habit of fits."

¹*Lancet*, March 10th, 1923, p. 501.

CHAPTER XXX.

ORGANIC DISEASE OF THE NERVOUS SYSTEM.

APOPLEXY. INFANTILE PARALYSIS. NEURITIS. LOCOMOTOR ATAXIA.

Organic disease of the nervous system will produce symptoms depending upon the neurones involved and upon whether these neurones are merely irritated or depressed, or are more or less destroyed.

As regards the motor neurones the symptoms will differ according to whether it is the upper or the lower ones which are affected. In upper neurone lesions: (a) if destructive, the corresponding muscles are paralyzed, but their nutrition is maintained and the electrical reactions remain unaltered. The reflexes soon tend to become exaggerated and the muscles often later pass into a condition of spasticity. (b) If the lesion merely causes irritation, the muscles tend to be convulsed.

Lesions of the lower neurones: (a) if destructive, cause paralysis of the muscles, but the paralysis is of a flaccid type and the muscles rapidly atrophy. The reflexes are completely lost and the electrical reactions are altered, in that the muscles cease to respond to the faradic current and do so in a changed manner to the galvanic (reactions of degeneration). The faradic current only acts on muscle through the motor nerves and hence, as long as any reaction occurs from it, we judge that the nerve is at least partially intact. The galvanic current acts both on nerve and muscle, so will elicit a response as long as any muscle tissue remains intact. (b) In irritative conditions of the lower neurones twitchings occur. Progressive muscular atrophy is an example of this form at first, although later many of the neurones are destroyed and the muscle-fibres atrophy.

Irritative lesions of the sensory paths give rise to all manner of abnormal sensory impressions. The chief one is pain, but those of formication, and of cold or of heat are common.

Destruction of the sensory neurones, of course, causes a loss of sensation of all kinds in the areas supplied by the affected neurones.

Very often, lesions of the sensory path may be partly destructive and partly irritative, in which case there will be a mixture of numbness and of pain or tingling or other abnormal sensation.

Many nerve-lesions involve both the sensory and the motor tracts and the symptoms are accordingly of a mixed type.

In considering the therapy of organic nerve disease only a few types can be taken, with the object of illustrating the principles and methods of treatment.

CEREBRAL HAEMORRHAGE AND SOFTENING. (APOPLEXY.)

This condition usually occurs in connection with the internal capsule, and produces hemiplegia of the opposite side of the body, with more or less evidence of cerebral pressure, and aphasia may occur.

Most cases of apoplexy show two stages : (1) the initial shock (or "cerebral surprise" as it is often termed) and (2) the stage of apoplectic coma.

But in the slighter cases these stages may not be evident, and the chief symptoms will be paresis or sensory changes.

Diagnosis.—When hemiplegia occurs, it is often difficult to determine the exact cause, but, in a general way, it may be said that it is probably due to haemorrhage, thrombosis or embolism, though not infrequently (when of a slight and passing nature) a spasm or localized oedema around an arteriosclerotic vessel may be the cause.

All these conditions, except embolus, indicate diseased vessels. Healthy arteries do not burst or permit of clotting of their contents. Embolus may usually be excluded when the heart appears to be normal, especially when there are no signs of mitral stenosis.

Sudden hemiplegia, in the absence of such heart disease, suggests haemorrhage, and, more gradual onset thrombosis.

A passing type of hemiplegia occurs in arteriosclerosis

with high blood-pressure. As it is difficult, sometimes, to tell to what a hemiplegia is due, the practitioner will do well to look on a given case as haemorrhagic in the absence of evidence to the contrary.

Environment.—When a patient has a “stroke,” he should be laid horizontal, with the head comfortably raised and turned to one side to lessen the chances of obstruction to the breathing from the falling back of the tongue. All constrictions about the neck should be loosened. If at all possible the patient should be kept where he is and not moved for at least 12 hours, as any disturbance may bring on a recurrence of the haemorrhage. No attempt should be made to rouse him or to get him to answer questions. The bladder must be watched, and, if necessary, emptied by catheter. This, by the way, is necessary in conditions of any kind associated with clouding of the intellect.

The patient should not lie for long in any one position, but should be gently shifted on to one side and then the other, and there supported with pillows, with the double object of avoiding the possibility of bedsores (which occur very easily here) and of hypostatic congestion of the bases of the lungs.

Any dental plates must be removed and the mouth kept as aseptic as possible by the frequent use of antiseptic swabs.

If much shock be present hot-bottles should be placed about the patient, with great care that they do not burn him.

Diet.—At first the patient may not be able to swallow, and in any case there is no hurry about food for a day or two, but if it be given it must be with caution or it may pass into the air-passages and cause trouble there. If the unconsciousness be prolonged for more than three or four days it will be necessary to feed by the bowel or through a nasal tube.

Specific Treatment.—Nothing can, of course, be done for the diseased vessels themselves, but in cerebral haemorrhage the bleeding may possibly be controlled by free venesection and drastic purgation, both of which tend to lower the arterial blood-pressure and to hasten coagulation of blood. In the transient cases, associated with high blood-pressure, and, possibly, cerebral oedema, the same measures are indicated, with

much more hope of success. Vaso-dilators, by lowering the blood-pressure, may also be of value. "They greatly diminish the cerebral circulation." (Hill.)

Direct compression of the carotid artery on the affected side has been done, and ligature of this vessel has even been performed. Where the coma is profound and evidently due to a haemorrhage, trephining may give relief, but this is unlikely to be so unless the haemorrhage be superficial, as occurs in cranial traumatism: then it may be urgently required.

When the hemiplegia is due to thrombosis or embolus, bleeding and drastic purgation should not be used, as they may do harm by increasing the tendency to clotting. On the other hand, stimulation may be employed. Possibly, citric acid or ammonia, freely given, may lessen the clotting that is so apt to continue to spread into other branches of the affected vessel. But where the coma in thrombosis or embolism is deep, it may (according to Mott) be due to venous engorgement, consequent upon arterial blocking, and then venesection and purgation may be of value.

In syphilitic cases a course of specific treatment should be cautiously given later on, and often the results are surprisingly good.

Symptomatic Treatment.—The bowels should be freely opened, especially in the haemorrhagic and oedematous cases. The best purgative here is croton oil, of which 1-2 minims may be given, mixed in a little butter, and put on the back of the tongue. Or elaterium may be used, in dose of $\frac{1}{4}$ - $\frac{1}{2}$ gr., or the elaterinum (dose $\frac{1}{20}$ - $\frac{1}{15}$ gr.).

If there be any symptoms of cerebral irritation, such as restlessness and headache, an ice-cap is usefully applied to the head. Severe headache is well-relieved here with bromides combined with phenazone, say, 20 and 10 grs. respectively, every eight hours.

Nothing beyond these measures is required at first. Later on, when the patient has recovered consciousness (if he does so), the paralyzed limbs should be passively moved and then gently massaged, in order to lessen the tendency to spasticity and contractures. The muscles do not atrophy to any extent,

as the lesion is in the upper neurones. If necessary, the faradic current may be used in order to make completely-paralyzed muscles contract. The galvanic current will not be required here.

The degree of recovery depends upon the nature and the extent of the lesion. In nearly all cases some trace will remain of damage to the nerve structures, especially in the arms.

The mental state is apt to be deteriorated, but in some instances this is not the case, and there are examples of individuals who have done good mental work after even a severe "stroke."

INFANTILE PARALYSIS.

This disease is chiefly one of childhood, but occasionally attacks adults. It is due to an infection which was isolated by Flexner and Noguchi. This invades the body through the mucous membrane of the upper respiratory passages and then attacks the meninges and extends into the substance of the cord or sometimes the brain. A round-cell infiltration occurs that interferes with the blood-supply of the nerve cells and these in consequence atrophy and die. Possibly, also, the toxins of the infection directly affect these cells. Thus destruction of groups of lower-neurone cells occurs with consequent paralysis of the muscles depending upon them. The motor centres of the spinal cord are the ones chiefly attacked, but occasionally those of the brain are involved, and the facial, lingual and pharyngeal muscles will show the results. Also, although the cells of the lower motor neurones are the ones generally affected, the rest of the central nervous system may not escape some damage. No doubt, some atypical cases of fever, without paralysis, are of this nature.

The disease is occasionally fatal, the mortality being much higher in the epidemic than in the sporadic form. At first there is fever and other generalized signs of infection, and soon paralysis occurs. To begin with, this paralysis may be extensive, involving, for example, the muscles of a whole limb or more, but much of it usually clears up after a few days, and only some of the groups remain helpless, and soon rapidly atrophy. Such muscles will show all the signs of a lower motor

neurone lesion, in that, in addition to the atrophy and paralysis, the reflexes disappear, the faradic current fails to get a response and soon the reactions of degeneration appear to the galvanic current.

Diagnosis.—The fever and general symptoms may be puzzling at first, but the rapid appearance of paralysis soon makes the diagnosis clear, although the distinction from a neuritis may often be difficult. When the disease is epidemic in a district, its recognition will, as a rule, be easy, but abortive and atypical cases may occur which can easily be missed.

Environment and Diet.—During the acute stage these will be as in any simple fever. The disease is now a notifiable one in many countries. The patient will be in bed and should be isolated from others. As a prophylactic measure it is well to keep his nasal passages and throat as aseptic as possible, and the same applies also to the attendants. A spray of Seiler's solution is useful for this purpose. The difficulties of prevention are rendered great by the fact that "carriers" are numerous and will show no evidence of their condition. All the same, as a rule, the dangers of direct transference of the disease from the sick to the well are small.

The diet at first should be a light fluid one and the bowels ought to be kept gently open with some mild laxative.

Specific Treatment.—Hexamine has been given in doses of 2-10 grs. t. i. d., and possibly has some controlling effect upon the infection at first. No curative vaccine has yet been obtained. Serum, obtained from immunized horses and also from the blood of children who have recently recovered from the disease, has been used with some favourable results, if given in the acute stage before the appearance of paralysis. It is given both intrathecally and intravenously. It was found experimentally that the intravenous method was necessary to protect monkeys from intra-cerebral inoculations of the virus. In children, 5-10 c.c. of the serum may replace a similar amount of cerebro-spinal fluid removed. At the same time 10-30 c.c. of it is given intravenously. Some of the results published are encouraging, but the method cannot be said to have yet got beyond the experimental stage.

Symptomatic Treatment.—During the acute stage, there is

often much pain in the affected limbs which may be treated by wrapping these in cotton wool, or by the application of heat in any form. Lumbar puncture often affords much relief.

No special treatment for the paralyzed muscles should at first be attempted beyond the general one of complete rest, including the relieving of them of all strain from the unopposed action of the opposite groups. For this purpose it is well to put the affected limbs up in plaster-of-Paris splints as soon as possible after the pain has subsided. If the leg be palsied the limb should be slightly flexed at the knee and the foot put at a right angle. If the arm be involved, the elbow may be slightly flexed and the hand hyperextended and the digits fully so. Sir Robert Jones urges the importance of keeping the affected muscles constantly relaxed and says, "The success of treatment depends upon undisturbed continuous relaxation."

For high fever a simple diaphoretic mixture, such as that mentioned on page 45, may be given with advantage.

When all acuteness has gone it becomes our task to endeavour, as far as possible, to restore the damaged neurones, including the muscles. Drugs are here of little value, but strychnine may have some influence in stimulating the motor cells, and so is frequently used after the acuteness has subsided. The completely destroyed cells are beyond repair, but the surrounding ones have only been functionally disturbed, and may perhaps be influenced for good by this therapy.

The chief treatment must be applied to the muscles themselves, with the object of keeping them in as good a condition as possible until the nerves recover to the fullest extent that can be hoped for.

At first (i.e., after about ten days from the onset of the trouble), gentle passive movements may be used and gentle massage. Next, the muscles should be caused to contract by the faradic current, if possible, or, failing this, by the galvanic. If any voluntary movement remain, this should be encouraged, and often a patient can move a limb when it be immersed in warm water when otherwise he has no power over it, and this should be taken advantage of to the fullest possible extent. The voluntary movements may be encouraged by playing with toys and by simple games that involve co-ordinated muscular

action. Skilled massage is by far the most important method at our command for maintaining the nutrition and contractility of paralyzed muscles, and it should be persevered in for many months (in combination with the use of the galvanic current) before all hope of any improvement in a group of muscles is abandoned. It will also lessen the tendency to contractures which are so apt later to occur and to cause deformities.

In spite of all treatment distortions may develop, partly from the unopposed contraction and tonicity of the opposite sound muscles and partly from contracture in the affected ones. Such deformities will require the use of various braces and splints, and, not infrequently, the operative services of the orthopaedic surgeon are necessary for the lessening of them.

NEURITIS.

Inflammation of the nerves may occur as a localized neuritis, or in the multiple form.

Localized Neuritis may be due: (a) to traumatism of any kind, as wounds, blows, pressure or stretching of the nerves, etc.; (b) to extension of inflammation from neighbouring parts, as is seen in paralysis of the facial nerve following ear trouble; (c) to cold. It is not an uncommon thing to see a facial paralysis following exposure of the face to a draught of cold air. The condition is usually called "rheumatic" here.

Multiple neuritis occurs: (a) in many infections, such as typhoid, scarlet fever and especially diphtheria; (b) in toxæmias, as in poisoning from alcohol, arsenic and lead; (c) in cachectic conditions, such as tuberculosis, cancer and anaemia; (d) in endemic form from dietetic error (Beri-Beri). (e) It may sometimes be set up also by over-exertion or exposure to cold.

The symptoms of neuritis are due, either to irritation of the nerves affected, in which case there will be pain, tingling, burning and twitchings; or to destruction of the nerves, when numbness and more or less paresis will result. Often these two sets of symptoms may occur together: thus we see pain

combined with numbness, and twitchings associated with weakness, etc.

There is generally much tenderness over the course and distribution of the affected nerves.

In localized neuritis there will be few general symptoms, but in the multiple form fever is common, and also all the symptoms usually associated with this, such as headache, loss of appetite and general malaise.

The multiple form is sometimes rapidly fatal, but as a rule the condition tends to clear up and leave little or no permanent damage.

Diagnosis.—The localized form is usually easily recognized, the tenderness in the nerve itself, the anaesthesia and the paresis all helping to differentiate it from neuralgia. In the latter also the pain is usually paroxysmal while in neuritis it tends to be constant.

Multiple neuritis may at first be mistaken for acute rheumatism, but the distribution of the pain, the anaesthesia and the muscular weakness soon make the distinction evident. It is often more difficult to distinguish it from *polio-myelitis acuta*, but in this the anaesthesia is usually absent. The distinction from tabes is easy. The steppage gait is quite different from that of the latter, and foot- or wrist-drop are rare in tabes and very common in neuritis.

The diagnosis should, if possible, include the causation, as the success of treatment will largely depend upon the recognition of this. Most of the cases of so-called brachial neuritis are really examples of arthritis of the shoulder-joint, which may cause referred pain, or, more rarely, sets up a true neuritis of the adjacent nerves.

Environment.—Absolute rest of the affected part is essential at first, and in all, except some of the localized cases, such as that of the facial nerve, this is best obtained by keeping the patient in bed. Where there is much helplessness great care is necessary to avoid the occurrence of bed-sores. Often an air or water mattress may be necessary. If hot-bottles are used they should not be too hot or severe burns may be inflicted without the patient being aware of it.

Diet.—Nothing need be specially noted here.

Specific Treatment.—It is often possible to attack the cause of a neuritis. Thus, in the localized forms, pressure or stretching may be irritating a nerve or inflammation may be spreading from some adjacent focus of inflammation, and when these causes are treated the nerve may soon recover.

In all forms of neuritis following cold, salicylates should be pushed as in acute rheumatism, and the acetylsalicylic acid (aspirin) is of special value in relieving the pain here. If syphilis be the cause, an active specific therapy must be adopted. In all toxic cases, such as those due to alcohol, arsenic, lead and mercury, an attempt can be made to relieve the system of the poison and of course to stop the intake of more.

In beri-beri the addition of food containing the needed vitamin B is required, such as unmilled seeds, yeast and eggs.

Symptomatic Treatment.—In the acute stage pain is the chief symptom that requires our attention. Locally, the application of heat in various forms is of service. Dry-cupping over the course of the affected nerves or the application of several leeches are useful (especially in facial paralysis), and a little later blistering may be used with advantage. Anodyne applications are often used, such as the A. B. C. liniment or one containing menthol, such as the one mentioned on page 94.

In the later stages, gentle massage is of value and the good effect of rubbing in various liniments is probably largely due to this. Internally, aspirin is useful, in doses of 5-10 grs. every four hours, even when the cause is not rheumatism. Aspirin is a much more powerful reliever of pain than any of the other salicylic bodies. Antipyrene is of use, and often a combination of aspirin and this is very efficacious. Often morphia will be required at first for the relief of the pain. When all acuteness has subsided, the paralyzed muscles will demand attention, and here massage and passive movements are of most value, and the massage should be continued as long as any weakness remain.

Electricity, in the form of the faradic current, or, if this does not produce contractions, then of the galvanic, is of some use where voluntary movements do not occur. Also, now, strychnine may be of service and should be pushed until some physiological effects occur. In many chronic cases the free use

of iodides is of value even in the absence of syphilis. When voluntary movements are possible they should be encouraged in every way, and here occupation-therapy of all kinds is of value and the weakened muscles gradually thus become re-educated.

SCIATICA.—This requires a special word of mention. It may be merely a neuralgia or be due to a neuritis. In most cases the treatment as outlined under the headings of neuralgia and neuritis will be sufficient, but in making the diagnosis it is well to remember that "sciatica" is often due to some pelvic trouble and a rectal examination should never be omitted, and often an X-ray investigation will reveal some condition of the bony pelvis which may account for the pain. In many cases the trouble is in the sacro-iliac joint and the pain down the nerve is referred from here.

When sciatica persists in spite of medicinal treatment, it may be necessary to use more radical local measures. Infiltration of the nerve with warm normal saline solution and eucaine is often of service. The nerve is found with a needle 9 cm. long in the neighbourhood of the notch and is anaesthetized with 2 c.c. of 1.5 per cent. solution of eucaine. Fifteen minutes later 100 c.c. of the warm saline solution is injected into it. The treatment may have to be repeated two or three times at intervals of a week. Or simple needling may be tried. Here the nerve is punctured at several points by a long needle, which probably acts by relieving tension within the nerve sheath. In still more persistent cases, surgical stretching of the nerve under an anaesthetic may be used or the nerve sheath can be split and thus the tension reduced.

LOCOMOTOR ATAXIA.

This condition is probably always syphilitic, although in many cases this infection is remote and the disease seems to have been at least precipitated by strain, excessive fatigue, or trauma. When one thinks of the large percentage of people that have had syphilis, as revealed by a positive Wassermann reaction, and of how few develop tabes it is evident that some precipitating cause such as those mentioned may be of importance.

Diagnosis.—The fully-developed disease is easily recognized, but in the pre-ataxic stage the diagnosis may be for some time in doubt, and slight arrested cases not uncommonly occur in which much diagnostic acumen is required. Also, the various crises sometimes lead the practitioner astray. One has seen the laryngeal crisis diagnosed as whooping-cough, and I recall a patient who had her abdomen opened twice for acute symptoms which were due to gastric crises.

When the diagnosis is made, the activity of the syphilitic infection should be gauged, as tabes occurring during the active stage of this is much more amenable to specific treatment than is that setting in later on.

Environment.—As long as the patient is able to go about it is well for him to do so, and many a man has done much useful and successful work, although a sufferer from the disease. He should avoid fatigue and strain and excesses of all kinds, as these tend to intensify the condition. The tabetic should be urged not to marry.

Diet.—An ordinary diet is permissible, but alcohol, tea, coffee and tobacco should be restricted. During gastric crises everything may be vomited, but often the meal may be retained if it be at once repeated. If not and when the crisis is of long duration, it may be necessary to feed by the bowel.

Specific Treatment.—This is that of syphilis (q. v.) and, as said, when the infection is of recent origin, the chances of cure, or at least of arrest of the process, with a great lessening of the symptoms, are fairly good. Even in late cases, however, it is well to pursue specific treatment with a good prospect of some relief of the symptoms. As discussed under the heading of syphilis, the intrathecal use of salvarsanized serum is probably of little value. In cases showing any optic atrophy it is better to rely upon mercury and iodides, rather than on salvarsan, as this is apt to make the neuritis worse.

Symptomatic Treatment.—The general health of the patient should be maintained in every possible way, and any intercurrent condition such as anaemia, etc., appropriately treated. Arsenic and strychnine are often of value in improving the general health, and a mixture containing five drops of tincture of nux vomica with half that amount of Fowler's solu-

tion may often be given with advantage. When the muscles are flabby and weak from want of use, massage and faradism may be used with benefit.

The lightning pains often cause much distress, and many drugs, in addition to specific ones, have been used for their indirect relief. Silver nitrate, in doses of $\frac{1}{4}$ gr. t.i.d., often is of value here, but must not be continued for more than two or three weeks at a time. Gowers advised the use of three-grain doses of aluminium chloride thrice daily, and lately Müller has extolled the value of fibro-lysin for the same purpose. Osler strongly recommended the prolonged use of nitroglycerin when the pains are associated with high blood-pressure.

When the paroxysms of pain are acute, complete rest in bed is indicated and hot baths may be employed with advantage. Counter-irritation over the spine has been recommended. If these methods be insufficient one may give aspirin, antifebrin or antipyrene, and occasionally morphia may be required, but should be avoided if possible as few patients are more apt to become morphinomaniacs than these.

The laryngeal crises may be relieved by the application of cocaine to the vocal cords, or a few whiffs of amyl nitrite or of chloroform can be used.

The gastric crises are often very distressing. They may be eased by gastric sedatives such as chloretone or orthoform. The application of a mustard leaf over the epigastrium is often useful. It is a good plan to let the patient drink freely of warm water during a paroxysm, as it is less straining for him to vomit this than to vomit when there is nothing to bring up. In prolonged attacks it may be necessary to feed by the bowel. In very persistent cases of vomiting the 7th, 8th and 9th dorsal posterior nerve-roots have been divided with fairly good results.

The re-education of tabetics is of great importance, and the patients, by perseverance, may frequently regain considerable control of their limbs. Fraenkel's method is to teach the patient to try and forget his old movement-memories, and to turn to a new series of these, which he learns by exercising his muscle-groups by persevering efforts, at first guided by his eyes, but later done while blind-folded.

A very serious trouble in these cases is irritability of the bladder, and, later, retention or dribbling of urine. The physician should see that the patient empties his bladder every two hours, and, if he cannot do this, then the careful use of the catheter may be necessary, as otherwise a purulent cystitis is apt to develop.

Any signs of joint-affection should be treated by absolute rest, if necessary, with splints, as Charcot's joints may occur with great swiftness and destruction of the tissues.

Mental changes are very frequent in tabes. Such may be functional and hence removable by psychic means, but, in only too many instances, the symptoms are indicative of specific involvement of the cerebral tissues and the patients drift into the condition of general paralysis of the insane.

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